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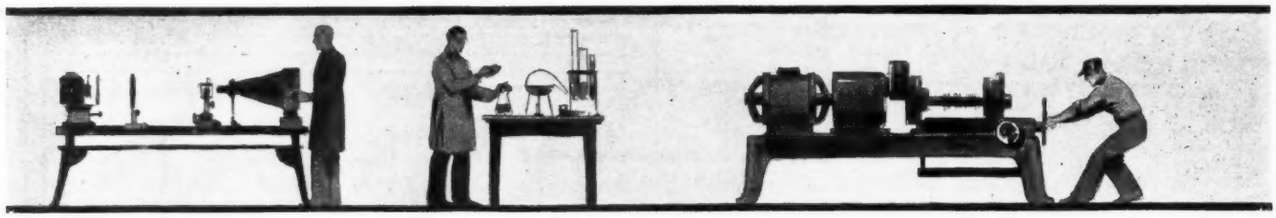

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AUTOMOTIVE INDUSTRIES
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Production *Efficiency* Outstrips Distribution Progress

BY DU BOIS YOUNG
President Hupp Motor Car Co.

PRODUCTION economies of the future depend on a number of factors which cannot be predicted with any degree of certainty. Currently, it seems to me, the production of automobiles is in as efficient a state as the advance in the art of design has made possible, but improvements in machines and materials have been made regularly in the past and I do not see why they should not continue in the future.

Specifically, any efficient manufacturer will always be ready to scrap equipment whenever new time- and labor-saving machines are designed. To ignore opportunities for reducing costs would be to fall out of step with the industry.

There are, furthermore, always possibilities that new materials will be made available which will enable the use, for example, of a smaller crankshaft, or of savings elsewhere in the chassis.

Again, if new cutting alloys are developed and make higher speeds possible, we can count on further economies. All these advances are within the realm of possibility, but to venture a prediction as to when they will come, or what form they will take, would be to assume a foresight denied to any man.

What we need just now, perhaps more than too close a consideration of further production economies, is study of means and measures for reducing distribution costs. It is a fine tribute to the capabilities of our production engineers and our tool and material suppliers that such should be the case.

Du Bois Young

Labor Stabilization

Proper Sales Planning

Careful handling of as best means of

LABOR stabilization in the automotive industry depends primarily upon the business progress of individual companies. So strong and fundamental is this single factor as to dwarf into insignificance all of those detailed matters of cutting working hours before reducing working forces, saving maintenance work for slack production times, and other policies which commonly have assumed the forefront in most discussions of ways and means of gaining greater stability of working forces for the industry as a whole.

This is the conclusion forced from examination of the records of employment of a large number of passenger car companies, from comparison of those records with production and sales figures and scrutiny of all of these specifically automotive data in relation to the general business trends in recent years.

The remedy for such labor instability as exists in the automotive field, in other words, seems certain to lie more in the hands of the marketing economists, the sales managers and the general executives than in those of the purely production or manufacturing executives.

Wholly on the basis of his own experience, the vice-president of one of our most successful passenger car companies gave it as his opinion a few months ago that careful marketing and sales planning can do far more than any other single thing to bring about a stable labor curve for an individual company—and through a number of individual companies for the automotive industry as a whole.

Study of a number of available statistical records bears out his belief fully. Take for example the curve in Fig. 1, which shows the variation in total number of employees for a group of consistently successful passenger car companies making cars in the middle and high-priced field. Only one sharp drop in that curve has occurred in four years. And it must be remembered that it is only the sharp drops in employment that bring about the major labor turnover costs for the manufacturer and the major social and economic harms to the worker.

A slowly declining employment curve, while it may result in important readjustments both on the part of the factory and the workers, nevertheless makes possible handling of those readjustments in such a way as to reduce to an absolute min-

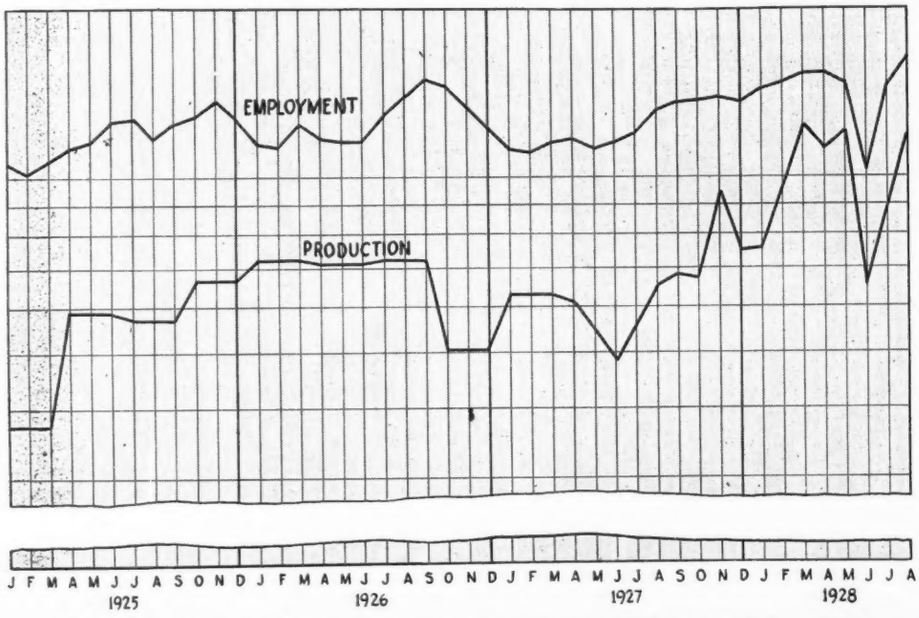
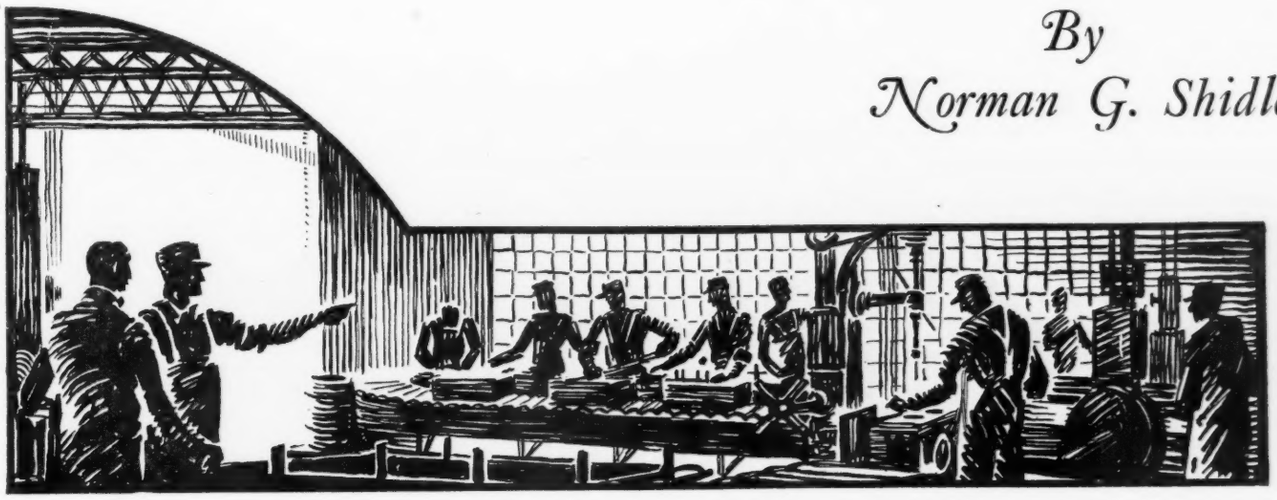


Fig. 1—Comparative trends in number of employees and output for a group of passenger car manufacturers



By
Norman G. Shidle

is Employment Factor

marketing problems seen keeping men at work

imum the harmful effects on both sides. Gradual reductions in working forces can be and usually are made by various means in addition to the single one of discharge. Deaths bring about certain automatic reductions in the force, as do voluntary retirements due to old age or disabilities, while a fair number of men voluntarily are leaving one job in favor of another all the time. A large proportion of any gradual cutting down of a workforce often can be taken care of through these automatic means, and thus with a minimum of disturbance.

Where this is the case, it is fair to say that a high degree of labor stability has been maintained, as that term can properly be defined as a "condition in which employment is available for those who wish it" rather than as the "continued employment in a given place of a fixed number of workers." The latter condition is neither practically possible nor theoretically desirable from the standpoint either of the worker or the employer.

The overwhelming effect on stability of working forces of general business progress as compared to even the seasonal influence—generally considered very strong in the automobile field—is rather well illustrated by the curves in Fig. 2 which show the number of employees by months of firms whose employing strength includes two-thirds of the working force of the manufacturing plants in the Detroit district. While companies other than automotive are included in these curves, it is the opinion of Chester M. Culver, general manager, Employers Association of Detroit, under whose supervision the data were compiled, that the peaks and valleys can properly be accepted as indicative of what would be shown by curves for the exclusively automotive companies.

On these curves, which run back for nearly eight years, it will be noted that only for the last week in December and the first week in January is there a consistently sharp decline in the employment curve every year. Otherwise the curves show no positive, consistent seasonal influence. This further tends to confirm the idea that general business activity is by far the greatest single dominating influence in producing employment stability or instability and that attempts to meet the problem by attacking other factors of acknowl-

(Continued on page 719)

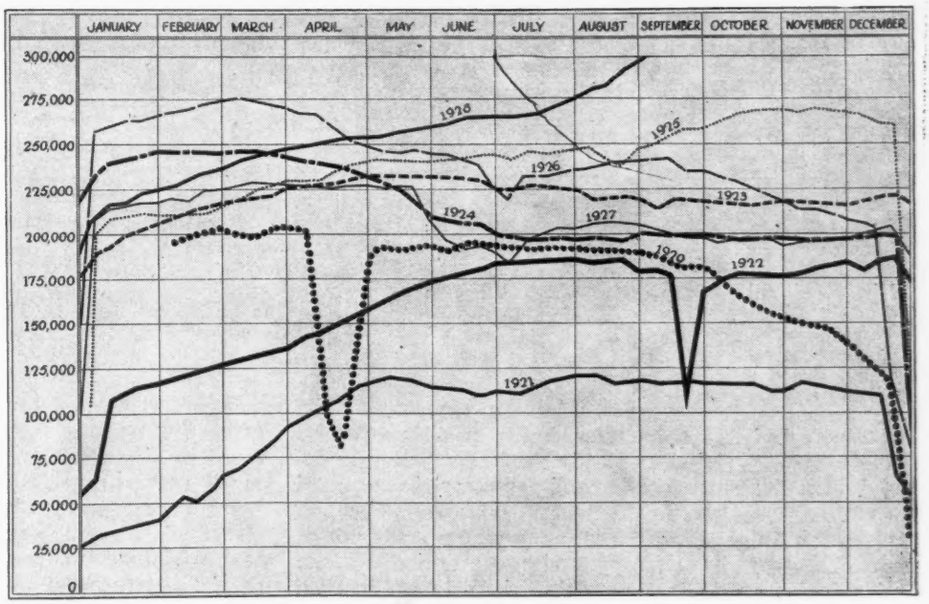


Fig. 2—Curves showing trends of employment by weeks in the Detroit district. (From data compiled by Employers Association of Detroit)

Simple System Solves *Production Control*

Difficult situation which confronts Ternstedt Mfg. Co. is overcome by method based largely on use of cumulative figures.

CONTROLLING production in a plant making a diversity of products is a difficult task under the best of circumstances. When the problem is complicated by the fact that the plant organization has practically no control over the design or the sales of its products but must ever be on the alert for sudden changes in design, cancellations of commitments or abrupt increases in requirements, it becomes one which might bring premature gray hairs to any production manager's head.

This is the sort of problem which confronts the Ternstedt Manufacturing Co., which supplies body hardware for a large proportion of the automobiles built in this country. Sales of body hardware obviously depend upon the consumer demand for complete cars and over this condition the Ternstedt sales force has no influence. Any steps taken to lay in a larger amount of materials than has been actually contracted for, in order to insure against possible delays in production, must be taken on the sole responsibility of the production department. If it guesses wrong that is too bad.

Further to complicate the problem, automotive engineers have long been noted for the continuous flow of ideas emanating from their brains and, according to Ternstedt experience, a considerable portion of these ideas contemplate changes in the design of automobile hardware. And, of course, when a new design is decided upon it must go into production immediately, so if large stocks of raw and semi-finished materials which have been obtained to insure early deliveries are made obsolete by the change, that, again, is just too bad and the production department gets another red mark on the management's books.

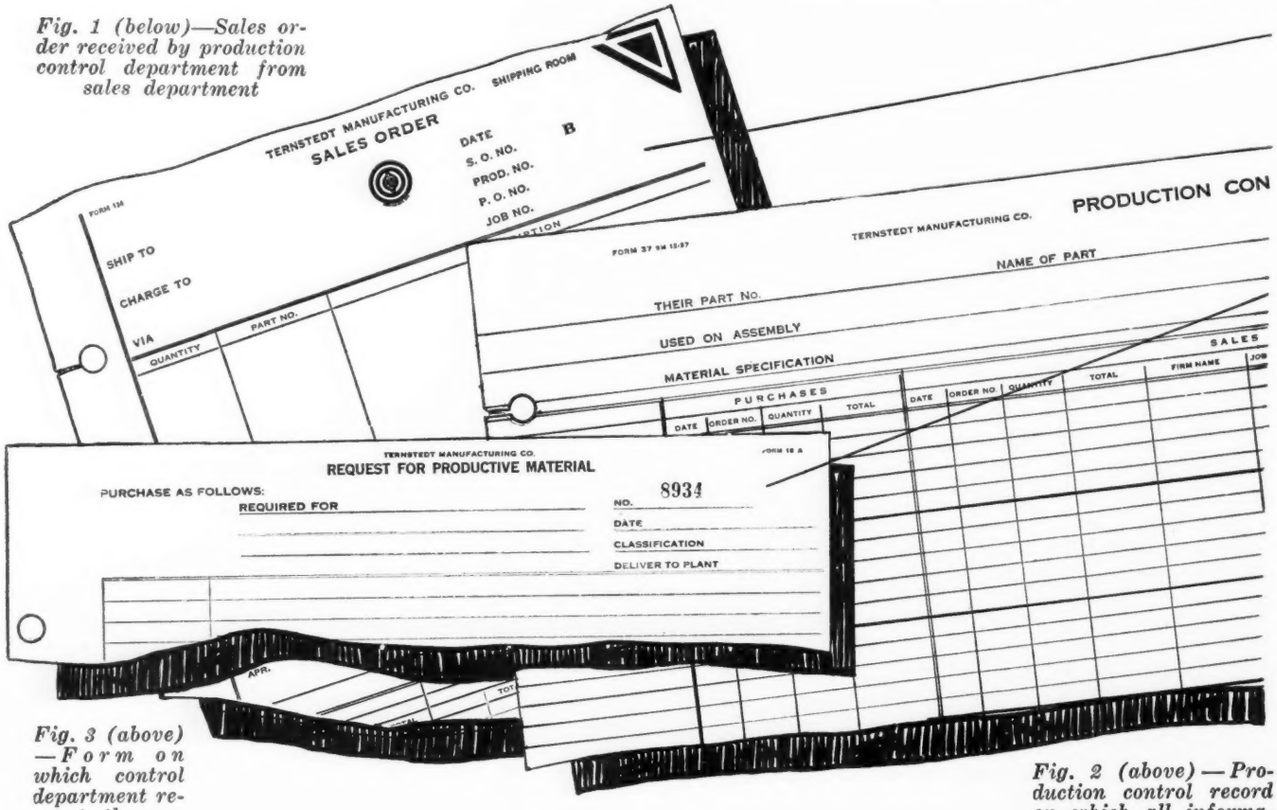


Fig. 1 (below)—Sales order received by production control department from sales department

Fig. 3 (above)—Form on which control department requests the purchasing department to obtain additional material

Fig. 2 (above)—Production control record on which all information pertaining to the items is entered. One of these record sheets is provided for each part and assembly manufactured

Complicated Problem

To one acquainted with usual practices in production control a problem of this sort involving annual shipments of considerable magnitude would indicate a solution through the use of a highly complicated organization with a multitude of records kept in shape by a small army of employees.

Ternstedt, on the contrary, has solved the problem in just the opposite manner and has a production control system which is so simple that one is justified, at first, in doubting its efficacy. But it works and has worked for several years. For controlling the production of over 4000 items of finished products, requiring between 12,000 and 15,000 separate parts, Ternstedt employs less than 20 persons in direct control activities.

Fig. 4 — This form authorizes the release of material for an order and starts manufacturing operations

Shipments are uniformly made on time, as a survey of any of the car manufacturing plants using Ternstedt products will prove, yet with all the difficulties the problem presents the rate of inventory turnover is from 10 to 12 times per year. By eliminating from the inventory the items of extruded parts, which not only are relatively much more expensive than other materials used but which also, unfortunately, require much longer times to secure, thus making large stocks necessary, the annual turnover of all the remaining materials is raised to nearly 20 times per year, a satisfactory figure under the best of conditions.

The outstanding features of the Ternstedt control method which are largely responsible for its simplicity

are the use of cumulative figures in all records for a period of one year—from one physical inventory to the next—and the great measure of responsibility placed upon each shop foreman for the control of operations in his department.

Control starts, of course, with sales orders but all production operations are based on schedules which are revised monthly. The sales orders come to the production department on the form shown in Fig. 1, of which seven copies are made—two for the production department and one each for the shipping department, cost department, material control department, sales department and the customer.

Each item called for on the sales order is then listed on the production control record, a sample sheet of which is shown in Fig. 2. In most cases the items called for consist of a number of parts and a separate control sheet is carried for each of these parts as well as for the assembly and the information from the sales order is entered on all.

The production control record contains the usual identification information in the heading and in the columnar part of the sheet is carried the information upon which schedules are made. Each order is listed separately to show the date it was placed, the order number, the quantity ordered, the purchaser, and, in the "Total" column under the main heading "Sales," is carried the cumulative sales of the item since the beginning of the inventory period.

Following the column giving the job number are several columns in which the schedule of deliveries for the order is entered, so that there is always available for every part made in the plant a complete record of how many pieces have been sold since the inventory period commenced and when shipments on each order must be made in order to meet the customer's requirements.

Fig. 5 (left)—Schedule sheet for each fabricating department. On it is entered all data pertaining to production activities for the month in the department

Fig. 7 (below)—Sale order revision form notifying the production control department of any changes in an order already entered

Fig. 6 (above)—Foremen make out these daily reports from the cost department man's records and the information contained is entered on the schedule sheets

Fig. 8—When a sales order revision necessitates a change in material on order this form conveys the information to the purchasing department

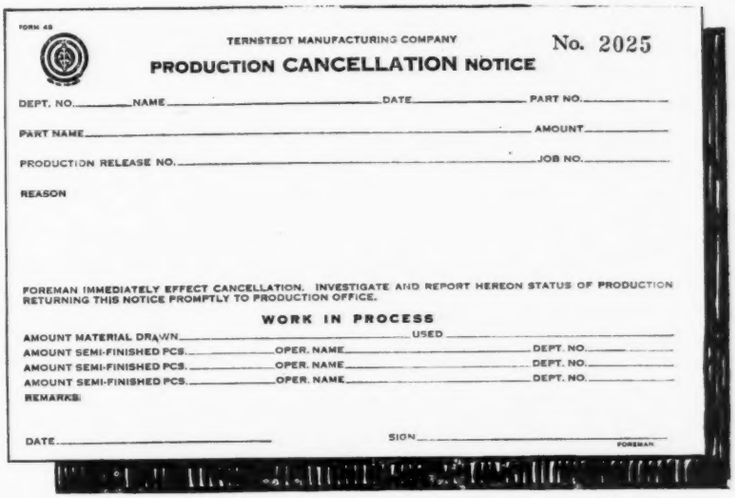
Two other main headings on the control chart are "Purchases" and "Parts Purchased or Released" and in these columns are carried information which tell the complete story of what is being done toward meeting the sales demands.

A very large proportion of the items manufactured are produced from bar or sheet stock and the purchases of these raw materials in anticipation of requirements are entered in the columns under "Purchases." Since many of the items made are small, all purchase and production records are kept in terms of weight. In the heading of the control sheet may be seen a space for entering the weight per thousand. This information is

provided by the engineering department for each item and it is the means by which sales orders calling for a certain number of finished items is translated into terms of weight of raw material required to produce them.

As sales accumulate against a particular part, attention is given to the amount of material which has been prevoiusly ordered and new orders are placed when necessary. The column headed "Total" under "Purchases" is also for cumulative figures so that the last entry in this column can be compared with the last entry in the similar column under "Sales" to determine what proportion of sales requirements have been covered by material purchases.

In the columns at the right of the sheet are carried the records of production. Here are spaces for indicating the number of pieces the factory has been authorized to produce and a cumulative total of how many have been shipped to compare with cumulative sales figures. Columns are also provided to show the stock required for orders and the amount actually released for production to provide a check against purchase orders.


FORM 49

TERNSTEDT MANUFACTURING COMPANY No. 2025

PRODUCTION CANCELLATION NOTICE

DEPT. NO. NAME DATE PART NO.

PART NAME AMOUNT

PRODUCTION RELEASE NO. JOB NO.

REASON

FOREMAN IMMEDIATELY EFFECT CANCELLATION. INVESTIGATE AND REPORT HEREON STATUS OF PRODUCTION RETURNING THIS NOTICE PROMPTLY TO PRODUCTION OFFICE.

WORK IN PROCESS

AMOUNT MATERIAL DRAWN USED

AMOUNT SEMI-FINISHED PCS. OPER. NAME DEPT. NO.

AMOUNT SEMI-FINISHED PCS. OPER. NAME DEPT. NO.

AMOUNT SEMI-FINISHED PCS. OPER. NAME DEPT. NO.

REMARKS:

DATE SION FOREMAN

Fig. 9—Production is stopped on any particular part or order by means of this notice

The most interesting thing about this control method is that it pays no attention to where work may be in the shop. A record is kept of what orders have been given to the factory for fabricating material. Another record is kept on the same sheet of shipments, but between these two events the foremen of the various fabricating departments are held strictly responsible for the work and this major control record does not interest itself in the intervening operations.

Each month, in preparation for a new schedule, the control records are scrutinized. If accumulated sales for an item call for more units than have been taken care of by purchase requisitions for the materials needed new orders are placed. Based not only upon actual sales orders already placed but upon the production department's estimate of future activities for each item, a request is sent to the purchase department on the form shown in Fig. 3 to procure additional material.

The delivery date specified upon the purchase request is based upon the present condition of material stocks, upon the delivery schedules of sales orders on hand and upon the knowledge which the production department has of how long should be given for procurement of the particular material being ordered. Once the request is made the purchasing department assumes full responsibility for obtaining delivery upon the specified date and must make special arrangements with the production department well in advance of the delivery date in case some unusual circumstances arise to make the promise impossible to keep.

The next step in the program is to start production in the fabricating shops and this is done by means of production release orders illustrated in Fig. 4. This is made in five copies and distributed to the cost department, the stock room, the material control department, the production department and to the foreman of the department where the first operation is performed on the material.

This production release is the only shop order issued, all other operations necessary on the piece being covered in the schedules which are issued to each foreman. The production release is authority for the foreman to withdraw from stock enough material to fill the order and it is issued a few days before schedules are distributed to permit the material to be withdrawn and the first operations placed under way.

Material control is handled almost entirely through these production releases and shipment reports. The foreman cannot draw out more material on any order than the order calls for and the stockroom records indicate at all times just how much has been withdrawn on any order. Once the foreman receives the material he is held strictly accountable for every bit of it, and, as will be shown later, the total number of finished pieces possible to make from the material originally issued must ultimately be shipped or someone has some difficult explanations to make.

A sample schedule is illustrated in Fig. 5, although in actual use vertical columns are added to the right to provide one for each working day of the month into which daily records are entered. A schedule is made out for each foreman and it contains a list of all the jobs he must produce during the month, including the total number required and, when necessary, the number to be produced daily in order to meet particular requirements.

A number of stock chasers, so called, operating under the supervi-

Chevrolet Six-Cylinder Car Description

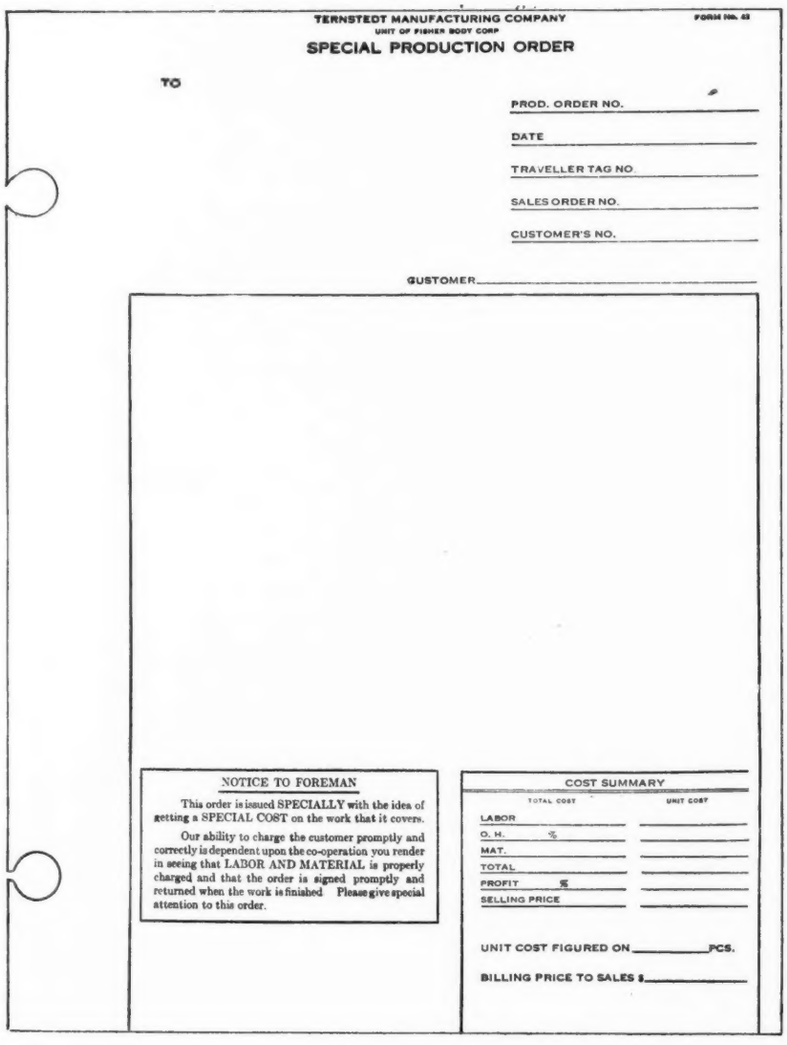
CHEVROLET MOTOR CO. has officially announced the introduction of a six-cylinder car to supersede the four, and to sell at practically the same price.

Much of the chassis remains unchanged, but bodies have been materially redesigned and the overhead valve engine is entirely new.

Delivery of the new car to purchasers will start Jan. 1, according to plans announced by the company.

Complete details of the car will be found on page 734 of this issue.

¶ *Fig. 10—Special orders are authorized by this form. Note the space for a summary of the cost of work performed*



TERNSTEDT MANUFACTURING COMPANY
UNIT OF FISHER BODY CORP
FORM No. 42

SPECIAL PRODUCTION ORDER

TO

PROD. ORDER NO.
DATE
TRAVELLER TAG NO.
SALES ORDER NO.
CUSTOMER'S NO.
CUSTOMER

NOTICE TO FOREMAN

This order is issued SPECIALLY with the idea of getting a SPECIAL COST on the work that it covers.

Our ability to charge the customer promptly and correctly is dependent upon the co-operation you render in seeing that LABOR AND MATERIAL is properly charged and that the order is signed promptly and returned when the work is finished. Please give special attention to this order.

COST SUMMARY

	TOTAL COST	UNIT COST
LABOR		
O. H. %		
MAT.		
TOTAL		
PROFIT %		
SELLING PRICE		

UNIT COST FIGURED ON _____ PCS.

BILLING PRICE TO SALES $_____

sion of the production department and who keep in close touch with the various jobs on hand through frequent conferences, confer each month with the foreman as soon as a new schedule is issued and inform them about the relative priority of the various jobs required for the month.

Aside from this information and the constant pressure from other foremen who may be waiting for material to keep their own men busy, each foreman is given practically complete control over the operation of his department. He follows the priority requests of the stock chasers not only because it is the line of least resistance but also because the foremen of other departments who have further work to perform on the pieces are anxious to maintain their own schedules and quickly bring pressure to bear upon any recalcitrant foreman who attempts to go his own sweet way.

Operation sheets are provided for each part manufactured and these are employed in routing jobs through the plant and in particular departments. But the foreman still remains the sole arbiter of how work shall be scheduled in his own department to keep his men and machines busy within the limitations imposed by the considerations mentioned before.

When work on a job is finished in a department the parts are placed in an allotted space where the quantity is checked by a representative of the cost department stationed there and is tagged for delivery to the next fabricating department. The record of inter-departmental shipments made by the cost department representative is the only information available concerning the location of any particular job between the time when material for its production is released and its final shipment, but it provides effectual control.

For example, suppose that the press department is given a material release for 500 lb. of bar stock, sufficient, we will say, for the production of 10,000 pieces, which are scheduled for delivery during the current month. Material control records show that the total amount of material has been withdrawn by the press department. From that time until the cost department representative checks out 10,000 finished items the press department foreman is held strictly accountable for all the material issued to him. Every item must be accounted for in some legitimate manner or the foreman is in for a disturbing chat with the management.

Practice is General

The same practice prevails throughout all the other departments so that once raw material or semi-finished parts enter a department its foreman is accountable for the eventual delivery of the full number which has been received. Even though many of the parts fabricated are small and particularly easy to lose or throw away inadvertently, the effect of this delegation of accountability has resulted in practically 100 per cent returns in finished pieces from the original material issues.

A copy of the cost department checker's record goes to the foreman who uses it to make out his daily production report, Fig. 6. Information contained in these reports is transferred to the production department's copy of the schedule sheet so that it shows at all times just what progress is being made in all departments and dangerous conditions are quickly noticed. This is facilitated by the use of red lines drawn horizontally across the schedule sheet opposite each item to indicate the proportion of the month's requirements which has already been met.

As is true in all organizations, the best laid plans can not always be carried out and the Ternstedt organization has to be specially well-equipped to handle unusual conditions. Frequently a form like that shown in Fig. 7 is received from the sales department which may call for revised quantities or a new design.

This may make necessary the cancellation or revision of materials on order and to take care of it the production department issues a change notice like that illustrated in Fig. 8. If changed plans make necessary the cancellation of production on an order already in progress a form such as shown in Fig. 9 is issued which not only halts fabrication but elicits information as to the amount of money which will be lost by the cancelling of the order. Another special condition is provided for by the form shown in Fig. 10, which is issued for special work which cannot be handled in the regular

¶ *Fig. 11—Back of form on opposite page, showing how all cost information pertaining to the order is carried along on the order sheet*

schedule and for which special cost information is desired. Cost information is carried on the back of the form as shown in Fig. 11.

This is the sum of the Ternstedt control methods and it still may seem too simple to perform the work it does. What is lacking in the picture and what cannot be adequately described is the high type of foremen which this plan produces and the cooperation which is present among all departments. With each individual responsible for certain results and getting the fullest measure of cooperation from all other members of the organization, artificial controls are unnecessary and simply add useless complications.

The management is interested only in two things pertaining to production control. It wants to know that material has been ordered and released to the fabricating departments in sufficient quantities to care for all sales requirements, and then that the finished pieces have been shipped.

For all intervening activities the various departments are responsible and the management has learned that this responsibility is justified. If material has been released for any order the management knows it is passing through the shops and, in an emergency, can be shipped within a very short time. In the absence of emergency conditions it is also known that the whole organization is working together to meet every shipment schedule. And in a surprisingly small number of instances do its efforts fail.

Synthetic Motor Fuels

SEVERAL papers presented at the recent Congress of Industrial Chemistry at Strasbourg dealt with the subject of synthetic motor fuels. M. Hugel, professor at the Petroleum College of Strasbourg University, outlined the results of experiments on the catalytic hydrogenation of tar pitch, which he has carried on for some years.

Catalytic hydrogenation of pitch by the ordinary processes is impossible, because such catalysts as platinum, nickel, copper and iron become poisoned rapidly by the sulphur content of the pitch.

The high pressure hydrogenation process of Bergius is applicable to pitch. The speaker gave the results of tests made under his direction on coke-oven tar pitch. By destructive distillation this pitch yields approximately 44 per cent of liquids. This same pitch, when hydrogenated by the Bergius process, becomes transformed into a tar containing 57.5 per cent of liquid products. Hydrogenation thus results in a material gain.

M. Hugel conceived the idea of utilizing the alkaline hydrates and the alkaline earths, such as sodium hydrate, potassium hydrate, calcium hydrate, etc., as catalyzers. The special constitution of these hydrates and the fact that they begin to dissociate at temperatures only slightly above their temperature of formation, gave reason for the hope that they would form excellent accelerators of hydrogenation.

It is possible to hydrogenate naphthaline in the presence of sodium hydrate under a pressure on the hydrogen of 150-300 lb. p. sq. in. and at temperatures of 450-480 deg. Fahr. Hydrogenation of anthracene is equally easy. Moreover, the catalytic activity of the hydrates is not diminished by the presence of impurities and poisons. It seemed a good plan to apply these catalysts to such materials as pitch, which cannot be purified.

Hydrogenation of pitch takes place under pressures of 1100-1400 lb. p. sq. in. at temperatures of 575 deg. Fahr., in the presence of from 7 to 10 per cent of catalytic material. There is obtained a highly fluorescent greenish liquid, in addition to black solid substance. Under these conditions the yield of liquids does not exceed 30 per cent, as a result of the catalyzer becoming ineffective. M. Hugel has looked for the cause of this neutralization of the catalytic effect, and he ascribes it to the colloidal nature of the pitch. After following out this supposition, M. Hugel succeeded in modifying his method in such a way as to obtain a yield of 80 per cent.

In following successive transformations of the pitch under suitable temperature conditions, it was noticed that the major portion of the hydrogenated product was absorbed without any apparent change in the constitution of the pitch.

Many Highly Specialized With *Standard*

Industry Finding Way to Reduce Obsolescence of Equipment Due to Design Changes

By K. W.

THE proper selection of machine tools for automotive plants is made especially hard by two factors which are sometimes in conflict. One is that the machine tool shall be capable of producing large quantities of complicated machined parts with rapidity. The second is the realization that designs are constantly changing, which may mean also complete changes in machining operations.

The first factor was considered most important a few years ago and led to the development of highly specialized machine tools, designed for a single purpose and so usually much more productive than any standard machine adapted for the particular job. So long as major changes in car design were not made such machine tools proved very satisfactory but when the advancing art of motor vehicle design called for slightly different parts it was usually found that the special machine tool could not be changed over but was made obsolete in the early stages of its useful life.

To compensate for this unsatisfactory condition, progress was begun in the work of adapting more or less standard machine tools to highly specialized machining jobs and at present this work has been very successful, as the examples in this article indicate. All sorts of machining jobs on every type of automotive part are being performed on standard machine tools equipped

Tapping Cylinder Blocks

A RECENT installation by the National Automatic Tool Co. for tapping the top and both ends of a cylinder block simultaneously (Fig. 1) has certain of the earmarks of a highly specialized machine although it is made up largely of standard units.

It is built up of two horizontal and one vertical tapping units with individual lead screws to each individual tap. A 30 hp. constant-speed motor drives the main reversing box which, in turn, drives each of the heads. The operator starts the machine by means of an air valve and the operation is automatic from then until the machine is stopped with spindles withdrawn after the holes are tapped.

The machine taps 30 holes in the top, 22 holes in the front end and nine holes in the rear end at the rate of 60 pieces per hour.

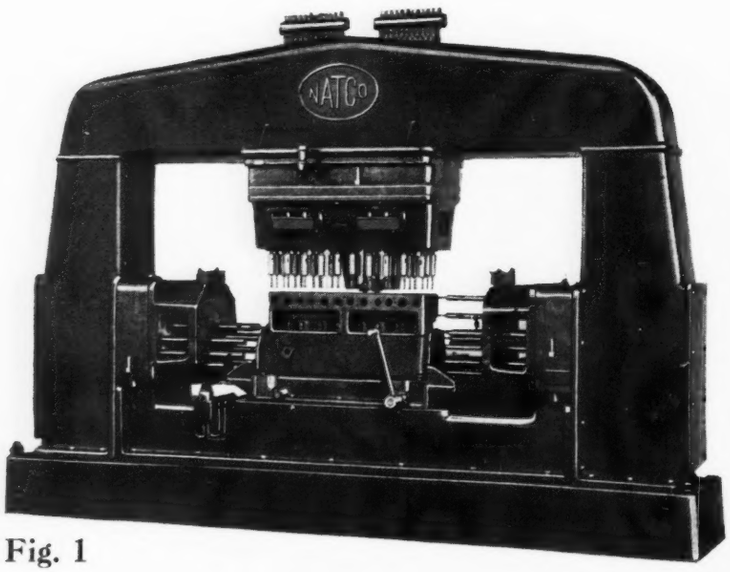


Fig. 1

Special Drilling Machine

THE accompanying illustration (Fig. 2) shows a special drill which has been built by the National Automatic Tool Co. for a well-known engine manufacturer to drill cylinder blocks. The equipment consists of two standard Natco Type C-6 hydraulic units and a center block upon which a conveyor type fixture is located.

The two units are identical from floor up to the tops of the slides—the cluster box and motor housings being designed to fit the job. The center block is also special to fit the size of the block being drilled. The fixture is of the conveyor type on which the block is slid into place on rollers. The rollers are then dropped and the block located on four pins. It is clamped by the hand wheel on top the fixture.

When the operator pulls the air valve the machine goes through a complete cycle of rapid forward, slow to drilling speed, drill to correct depth, rapid reverse and stop. If the design of the piece for which the equipment is intended is altered it is only necessary to equip the two units with new boxes and provide a new center block.

Production from this piece of equipment is relatively large and it has been obtained with practically no loss of flexibility.

Jobs Now Being *Performed* Machine Tools

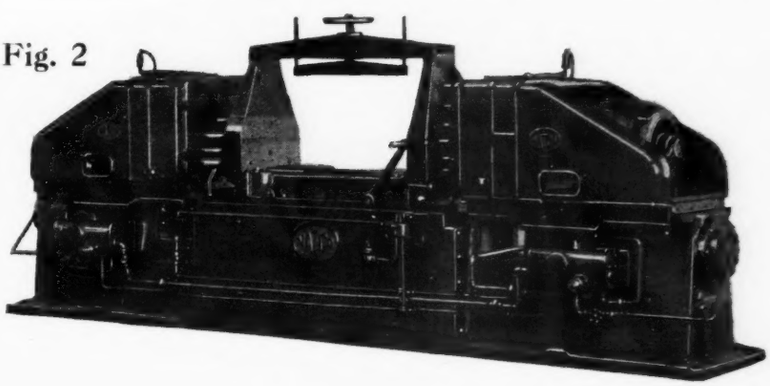
Special Work-Holding Fixtures and Tooling Arrangements Make for Flexibility

Stillman with special work-holding fixtures and tooling arrangements. In many instances the productivity of these machine tools is as great as could be obtained with specially-designed machine tools but they have the unique advantage that if machining methods need to be changed only inexpensive fixtures have to be scrapped, the machine tool itself continues its life of usefulness.

The swing has not eliminated special machine tools by any means and is not likely to do so. There is still and probably always will be a relatively wide field for special machine tools, not only in producing those items in which design changes are few and far between, but in the production of certain parts where the productive economy of the special tools is sufficiently great to warrant their use even though they may become obsolete within a short time.

To indicate more forcefully the extent to which the adaptation of standard machine tools to special machining problems has been carried, there are presented here a large number of typical examples taken from the production lines of representative automotive companies. The examples concern many different types of machine tools, working on a large variety of automotive parts and should suggest many new ways in which particularly difficult machining operations might be performed on standard tools.

Fig. 2



A Milling Operation

CYLINDER blocks are milled in a standard vertical milling machine (Fig. 3) made by Kearney & Trecker which has been provided with a special fixture which eliminates the usual table and saddle of the machine. The fixture movements are controlled by a cam which is driven by pick-off gears from the feed box.

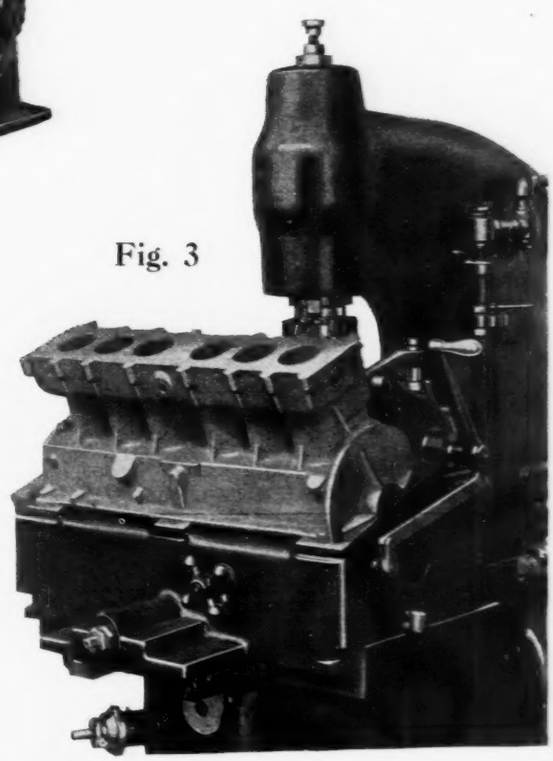
The block is located on and clamped to hardened steel plates. The unit is semi-automatic and when once started completes a full cycle to automatic stop for unloading when the operation is completed. After placing the block in position the operator pulls a combination clamping and dowel raising lever and then releases the clutch pin, after which the fixture with the cylinder block rapidly traverses up to cutting position, slows to cutting feed and returns to starting position automatically.

Estimated production from this equipment is from 80 to 90 pieces per hour.

Finishing Gear Housings

A SPECIAL rotary fixture with seven stations is fitted to a Kearney & Trecker No. 2 Standard rotary vertical milling machine (Fig.

Fig. 3



4) for milling gear housings. Each of the seven stations holds three housings, one in each of the three different positions necessary for complete machining, so that seven housings are completely machined at each rotation of the fixture.

The work is held down on locating pads and against generous stops and is clamped in place by toggle clamps which swivel on a trunnion properly located automatically to draw the work against the pads. The pieces themselves are held in place by a specially designed spring which applies a pressure of 2000 lb. against the work piece.

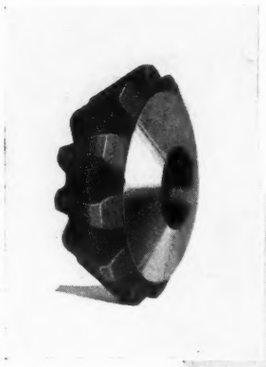


Fig. 5

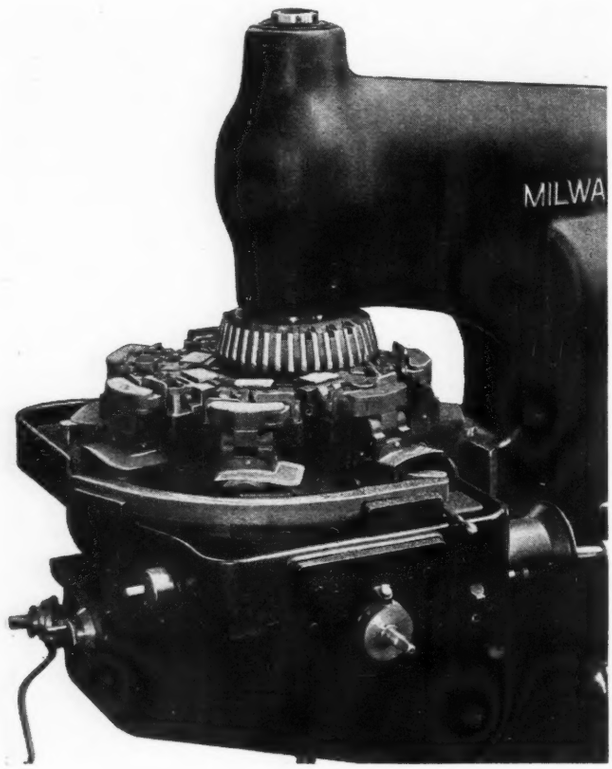


Fig. 4

Clamping and releasing of the work are both performed automatically through a toggle lever which is mounted on the periphery of the fixture and which is actuated by a cam mounted on the table of the machine.

Grinding Beveled Pinions

THE accompanying illustrations (Fig. 5 and Fig. 6) show a beveled pinion and the special arrangement of a Norton 10 by 18 in. Type A grinding machine being used by the Timken-Detroit Axle Co., to grind its spherical back. The operator swivels the work holding attachment with his left hand while he feeds the wheel with his right. When ground to size he pushes the attachment away from him to a stop which automatically throws out the driving clutch and releases the collet which grips the work.

This pinion is of hardened steel from which 0.012 in. of stock is removed to tolerances from 0.0005 to 0.001 in. When the closer tolerance is maintained production is about 130 per hour, while with the larger tolerance output can be increased to 350 per hour.

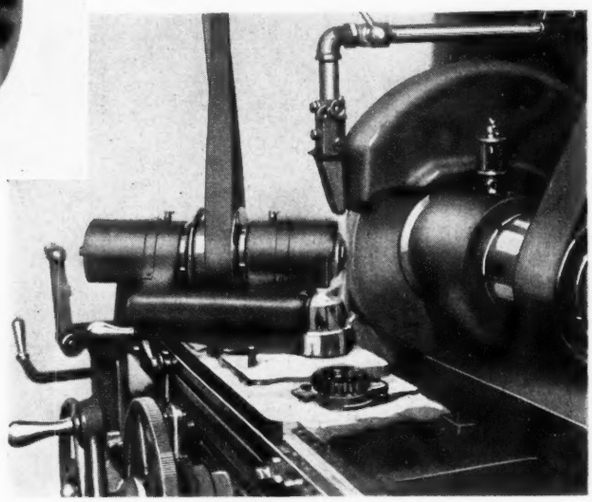


Fig. 6

Vibration Damper Flywheels

IN a well-known automotive plant 40 vibration damper flywheels are machined per hour by one operator running a battery of four Potter & Johnson 5D Power-Flex automatics. As shown by the sketch (Fig. 7) two holdings must be used and two machines are employed for each holding. Machining time for each holding is 2.6 minutes per piece with a production from each machine of 10 pieces per hour giving a total output from the four machines and one operator of 40 per hour.

In another plant this same machine is used to completely machine a rear wheel hub (Fig. 8) in 3¾ minutes. Output of 15 pieces per hour is obtained and one operator can care for four machines having a total output of 60 pieces per hour.

Fig 8

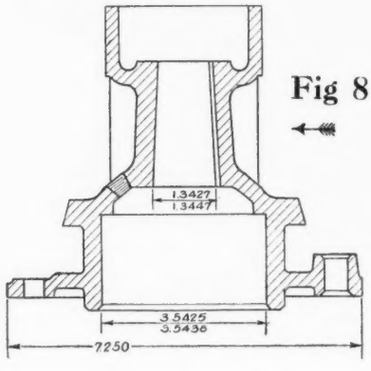


Fig. 7

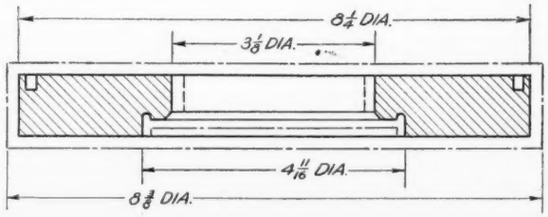


Fig. 9 →

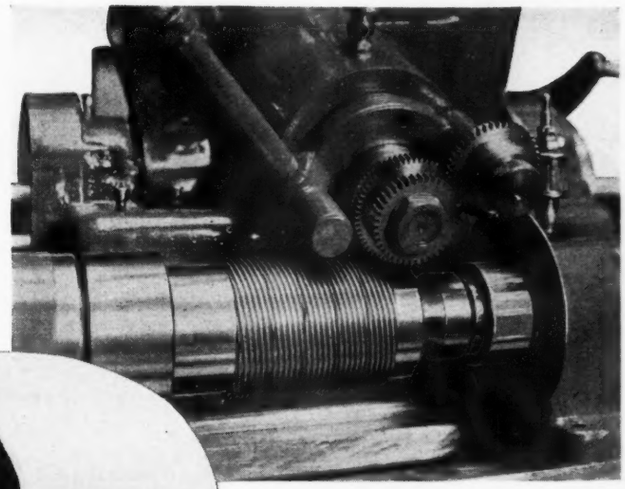
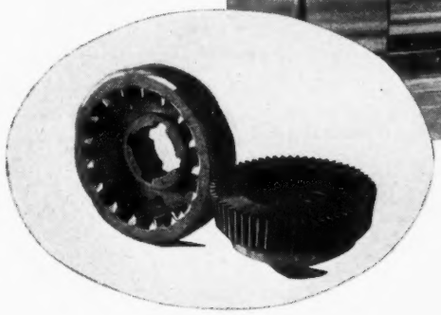


Fig. 10 ↓



Speedometer Drive Worms

SPEEDOMETER drive worms used in a well-known automobile transmission are cut in the Fellows thread generator as shown in Fig. 9. The worm is 3 49/16 in. outside diameter, has a 29/32 in. face and involute worm threads of 20 pitch. It is made from an alloy steel forging and five blanks are completed in one cut and at the same setting in the thread generator. Productive savings by this method over that formerly employed has been over 60 per cent. Fig. 10 shows the cutter used, on the right, and one of the worm blanks.

Gear Shapers

GEAR shapers as made by the Fellows Gear Shaper Co. are another type of standard machine which have a very wide variety of applications in the production of helical gears, internal gears, cams and similar parts.

In the first illustration of this group (Fig. 11) a gear shaper is being used in cutting internal gears for Twin High, four-speed transmissions, by means of which a rear axle ratio of about 3 to 1 is made possible.

Fig. 12 shows a Fellows No. 6 type gear shaper which is used by Wright Aeronautical Co. The cams which operate the valves are being cut in this machine and are cut in the same piece which carries the internal gear used to rotate the cams—also cut in a gear shaper. Fig. 13 shows the work with the internal gear teeth already cut and the type of cutter used.

Another application of the gear shaper is shown in Fig. 14 in which helical timer gears for a well-known engine are being cut. This method eliminates selective fitting of gears but they are picked at

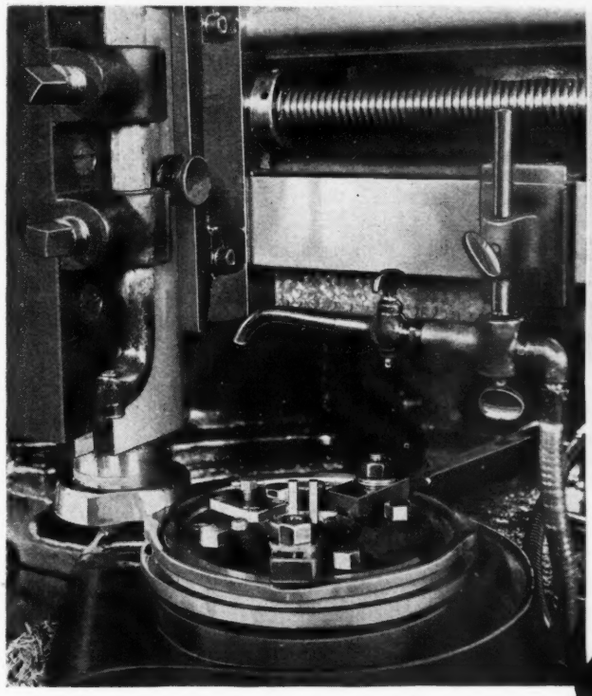


Fig. 12

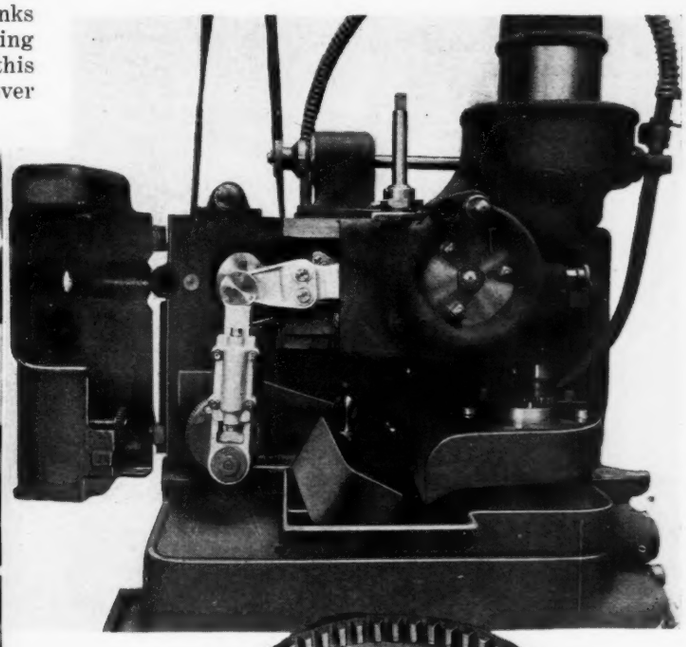


Fig. 11 ↑

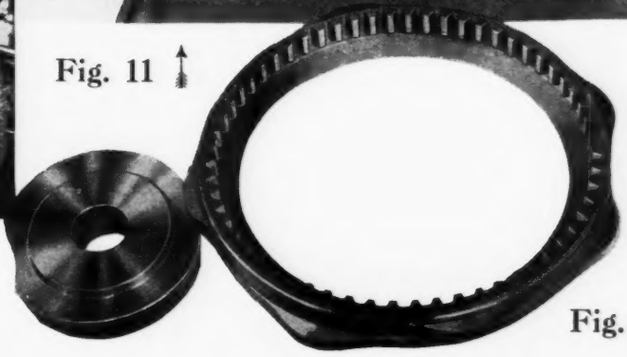


Fig. 13

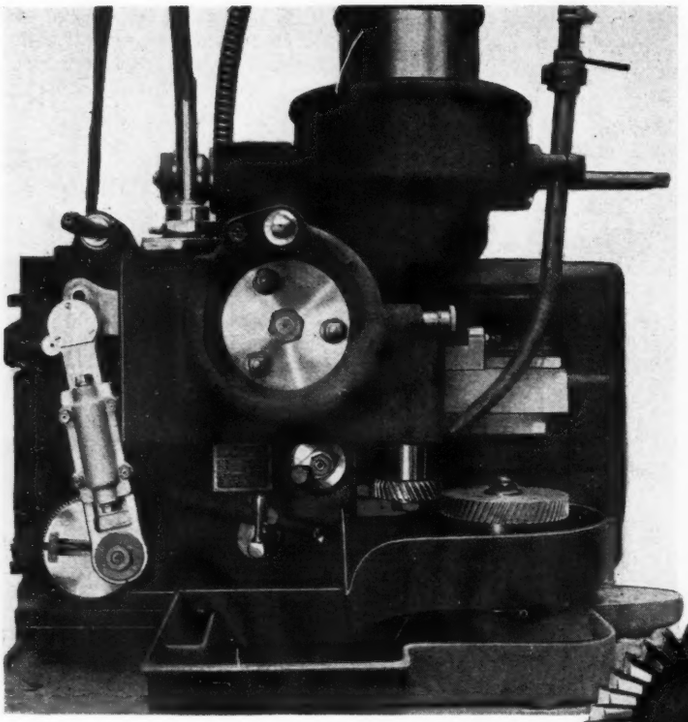


Fig. 14

Transmission Gears

THE Ford Motor Co. uses a specially-shaped wheel and a Norton Type BA hand traverse grinding machine to grind the groove in transmission gears (Fig. 18). A table end stop is used for locating the work relative to the wheel. The material is heat-treated alloy steel from which from 0.008 to 0.011 in. of stock is removed from the sides of the groove and from 0.005 to 0.010 in. from the bottom. Tolerances are 0.004 in. on the width of the slot and 0.005 in. in the diameter at the bottom of the groove.

A special switch is provided at the left of the machine for shutting off the power to the headstock when the table is moved to the left. This also releases the collet which permits removal of the work from the fixture.

random and assembled with a final rejection of less than 2 per cent. Fig. 15 shows the gear at the right and the cutter used at the left.

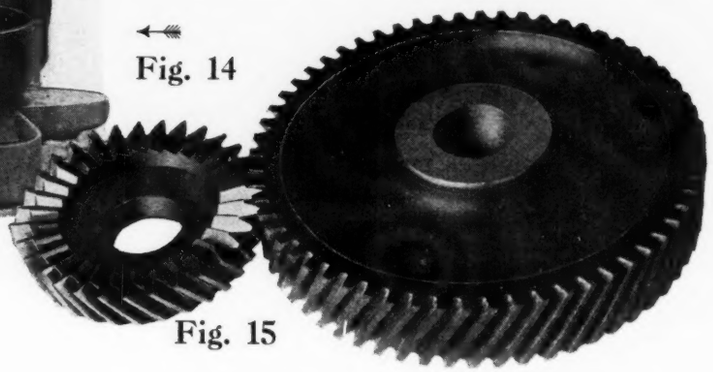


Fig. 15

Internal Splining

INTERNAL splining operations on an internal gear blank are performed readily in a Pratt & Whitney vertical gear shaper (Fig. 16).

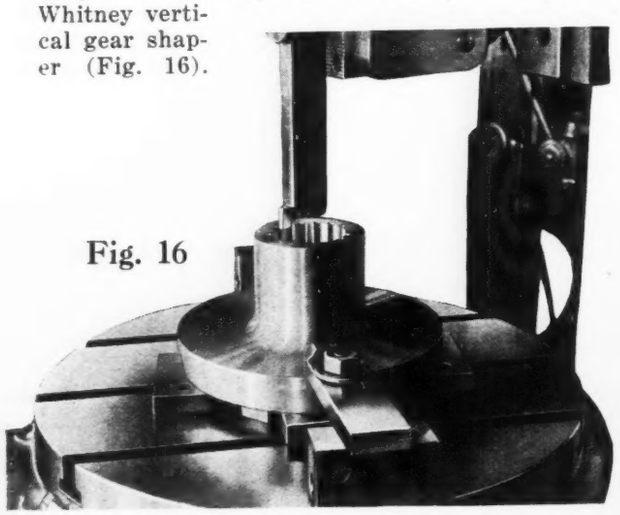


Fig. 16

Chucking Grinder Adapted

FEW concerns grind the hole in the front end of the crankshaft although it would appear to be beneficial in order to provide a more central and rounder hole for the suspension of the driving gear. Of the few who do grind this hole Continental Motors Corp. has adapted a Bryant chucking grinder for the job. A supporting stand is placed beneath

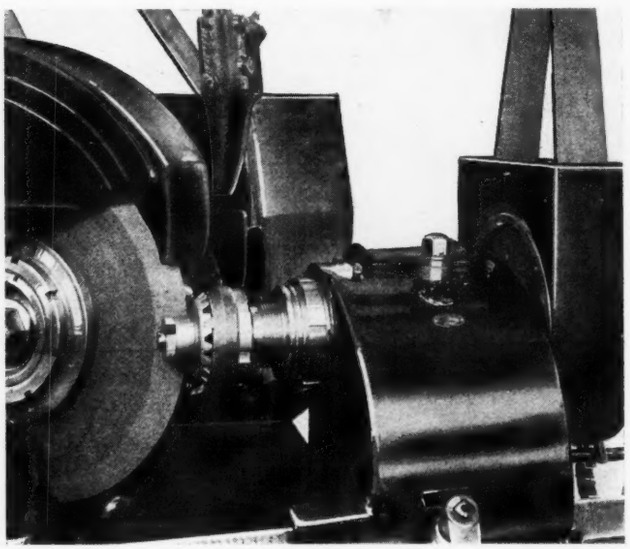


Fig. 17

Differential Side Gear

AT the Reo plant in Lansing an offset wheel slide is employed in grinding a differential side gear (Fig. 17). A Norton grinding wheel is used to remove from 0.005 to 0.010 in. of stock from the back of the gear, and from 0.015 to 0.020 in. from the diameter to tolerances from 0.0015 to 0.002 in. A special live spindle attachment is used as shown in the illustration. Production to give a good commercial finish is from 75 to 80 finished pieces per hour.

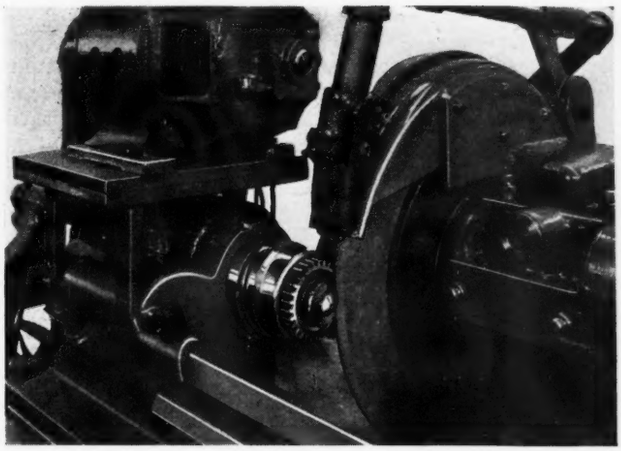


Fig. 18

the chuck for loading the heavy piece, the stand being operated by a lever which permits it to be lowered out of the way when the shaft is chucked. A steady rest is used at the front end of the shaft. From 0.008 to 0.010 in. of stock is removed to a 0.001 in. tolerance with an output of 30 crankshafts per hour.

Surface Grinder Uses

TWO widely varying uses of a Pratt & Whitney vertical surface grinder are found in the plant of Palmer Bros. Engine Co., maker of marine engines, in which the sides of marine engine crankshafts are being ground for balance in one operation (Fig. 19), and both sides of a six-cylinder head are being ground in the other (Fig. 20).

In neither case are fixtures required, the work being held on a magnetic chuck.

Connecting Rod Bosses

ANOTHER plant employs a Brown & Sharpe No. 13B plain milling machine to straddle mill connecting rod bosses (Fig. 21) and turns out 110 pieces per hour. The table travel has been lengthened 12 in. over the standard, a special two-spindle head is employed and the fixture has a two-station index with two rods at each station.

The material is steel forging, the length of cut is 2 1/16 in., and eight inserted teeth, side milling cutters are employed, four of 7 in. diameter and four of 7½ in. diameter. All run at 49 r.p.m. Cutting time is 55 sec., return time is 5 sec., and indexing time is 5 sec., thus giving 55 cuts an hour or 110 complete rods.

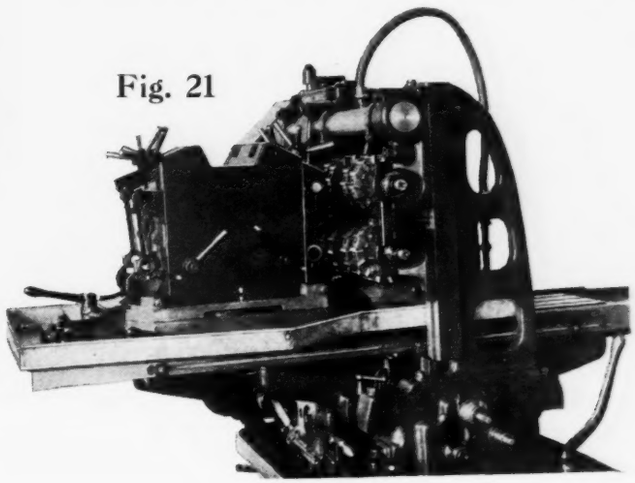


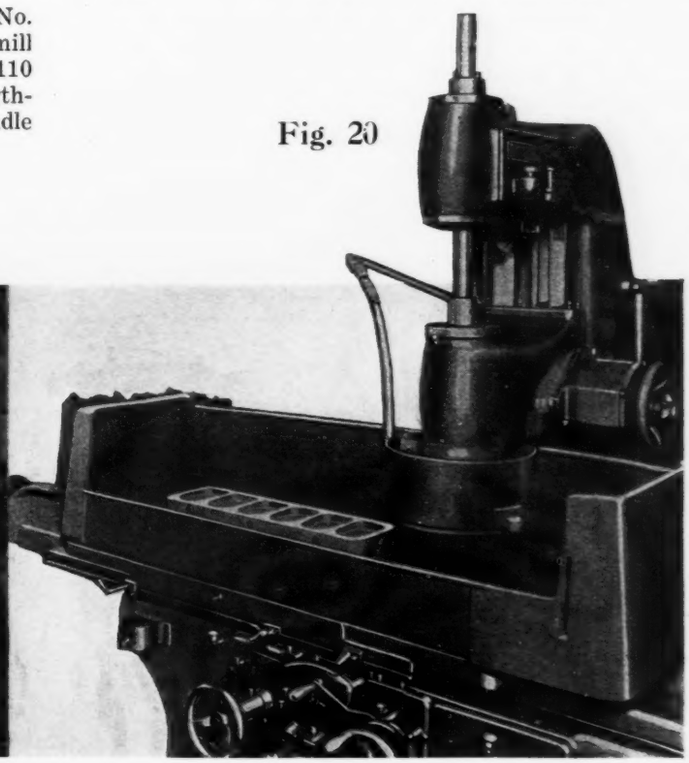
Fig. 21

Rotary Type Work Table

ANOTHER plant grinds both ends of connecting rods in a Gardner No. 84 double head grinder fitted with a rotary type work table (Fig. 22). The machine is semi-automatic in action, the operator simply loading the carrier and the parts being discharged by gravity. The overall stock removed from the rods is about 1/16 in.; they are held to tolerances of plus or minus 0.002 in. in thickness and about 300 rods per hour are produced.

Fig. 19

Fig. 20



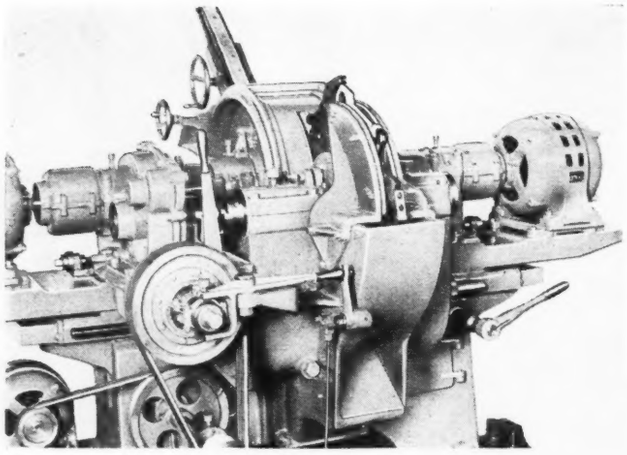


Fig. 22

Wide Wheel Grinding

AN interesting use of wide wheel grinding is found in the Plainfield plant of the International Motor Co., where truck engine connecting rods are being ground in Norton type BA special purpose grinders (Fig. 23). Removing from 0.025 to 0.055 in. of stock, an output of 45 rods per hour is obtained.

Piston Rings Protected

THERE has been some hesitation among engine makers as to the advisability of internal grinding piston rings because it is believed that some useful metal may be removed besides just the high spots which the operation is intended to reduce. Buick engineers have reduced the possibilities of this by equipping their Bryant chucking grinders with three rubber rolls geared to the work spindle. The rings are held by these rolls and are revolved by them. The pressure of the grinding wheel is taken up by the rubber rolls so that no stock is removed but only the high spots are smoothed. A production of 1700 rings per hour has been obtained by this method.

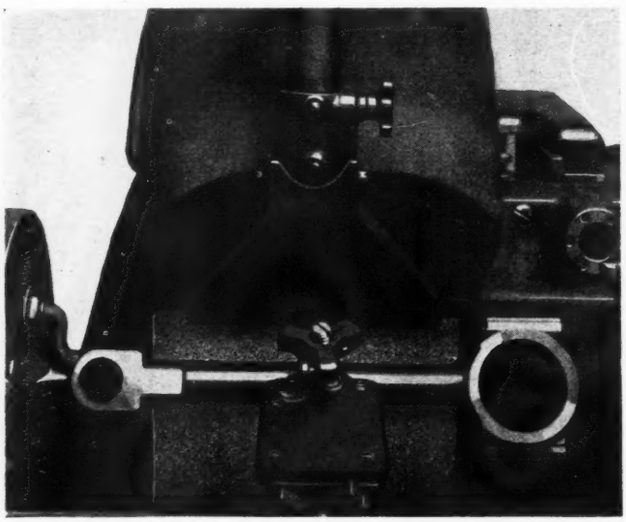


Fig. 23

Ring Gage Blanks

AN interesting grinding operation is shown in Fig. 24, in which approximately 100 ring gage blanks are being ground simultaneously in a Pratt & Whitney vertical surface grinder. By use of a magnetic chuck a large variety of pieces and parts can be ground readily without any need for expensive fixtures and set-ups.

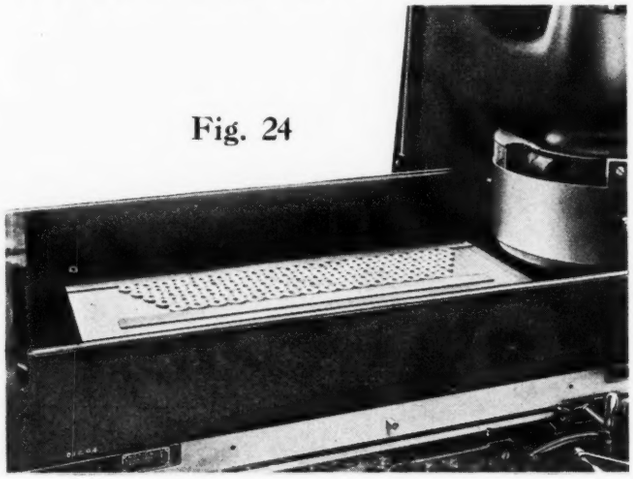


Fig. 24

Brake Operating Wedges

IN one plant steel forged, front brake operating wedges are milled in a Milwaukee heavy manufacturing milling machine (Fig. 25), made by Kearney & Trecker. The milling machine has a two-spindle head and special rotary tables have been mounted on a sliding base. A master cam which bears against suitable rollers gives a sliding movement to and fro to each rotary table.

After one side of the cams are milled they are turned over and the opposite side is milled in the same fixture. Approximately 336 complete pieces per hour can be milled with 15 and 29-deg. angles.

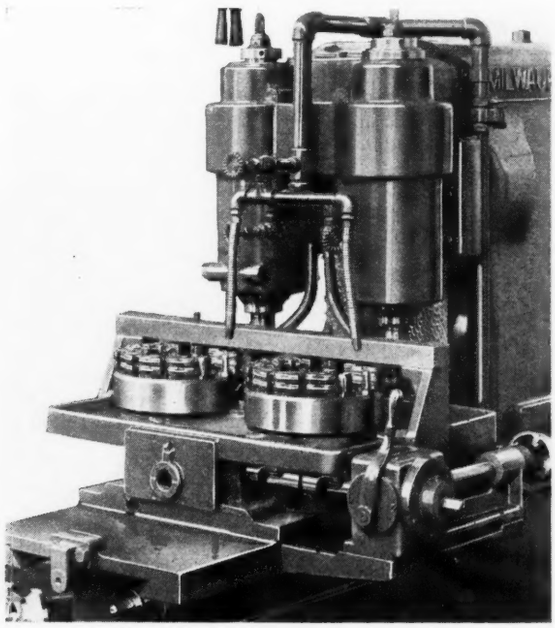


Fig. 25

Two Houde Methods

SOME interesting experiments have been made by the Houde Engineering Co. in discovering means of economically grinding wing shafts for its shock absorbers. Two methods have been standardized, the difference between them being that the method permitting the greater output entails larger installation costs.

In the more productive method two wheels are employed in a Norton semi-automatic machine (Fig. 26) to give an average production of 116 pieces per hour. The wheels are arranged as shown in the accompanying diagram, Fig. 27. The material ground is a previously turned steel forging from which 0.020 to 0.045 in. of stock is removed to tolerances of 0.0005 in. A single, diamond, multi-wheel truing device is employed.

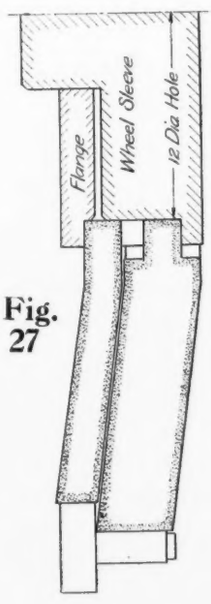


Fig. 27

The second method for grinding this part employs a 45-deg. offset wheel slide (Fig. 28). A special right-hand live spindle attachment is used and the wheel is trued on two faces to grind both the small diameter and the shoulder simultaneously. The foot stock is air operated by the lever shown in the illustration. Production by this method is about 75 per hour.

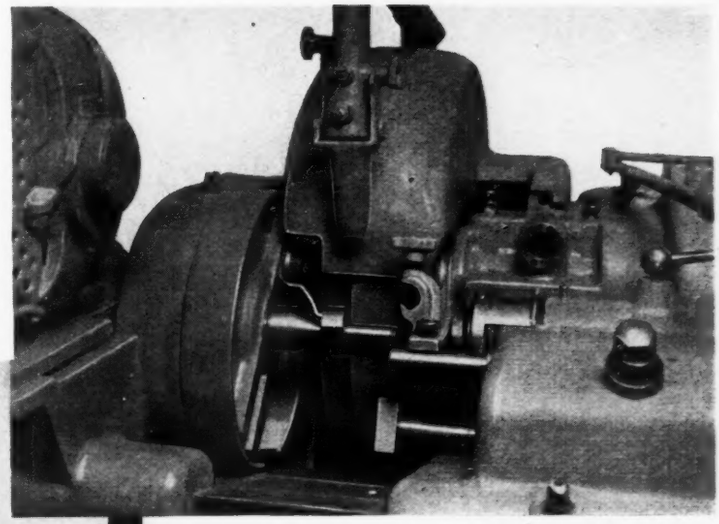


Fig. 26

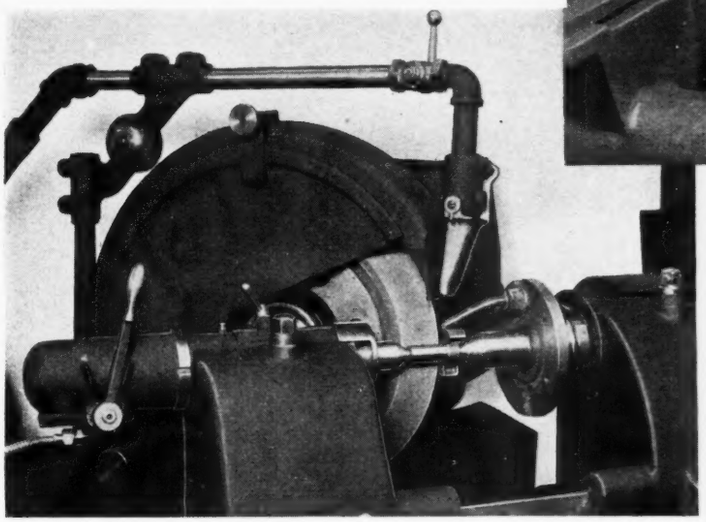


Fig. 28

An endless chain, fitted with numerous studs to fit the bore of the shells, carries them automatically between the grinding wheels. The shells are placed on the chain by hand but are automatically set in position for the first grinding operation, are automatically indexed 1/3 of a revolution before passing through each succeeding pair of wheels and are unloaded by gravity. A production record of 7000 complete shells per hour has been made with this equipment.

Milling Universal Joints

THE accompanying illustration (Fig. 30) shows a Brown & Sharpe No. 33 automatic, but without the automatic spindle, set up for straddle milling universal joints at the rate of 97 complete sets per hour. The material consists of steel forgings and the speed used is 69 r.p.m. and the feed 2.70 in. per min. The length of the cut taken is 1 7/16 in. and the cutting time is 32 sec.

The spindle operates continuously in one direction, the table stopping at each end of its travel. A cut on each end of the table finishes a complete set of joints.

Fig. 29

Setup for Spark Plugs

A SPECIAL setup of Gardner grinders is being used by the AC Spark Plug Co. to grind the hexagonal sides of their spark plug shells. The equipment employed (Fig. 29) carries three pairs of grinding members set directly behind each other.

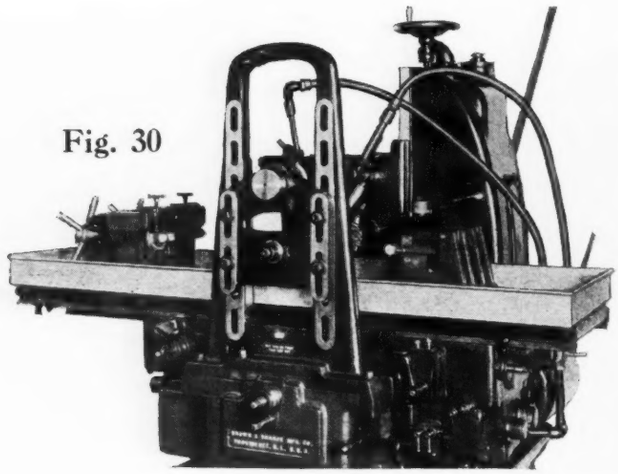


Fig. 30

Valve Tappet Heads

A SPECIAL arrangement of a Gardner 18-in. semi-automatic grinder is used in another large plant for grinding valve tappet heads (Fig. 31). The tappets are of hard steel, from which about 1/16 in. stock is removed. The work is handled dry on an abrasive ring wheel with the permitted tolerance in overall length being plus or minus 0.010 in. Output of 8 or 9 heads per min. is obtained with this equipment.

Nash Manifolds

IN the Nash plant intake and exhaust manifolds are ground in a hydraulic surface grinder fitted with a fixture of the indexing type which permits the operator to load one station while the second is being presented to the grinding wheel (Fig. 32). The manifolds are of cast iron and about 1/16 in. of stock is removed from three ports. They are ground flat to tolerance of 0.004, using an abrasive ring wheel cutting dry. The production is 75 manifolds per hour. The grinding machine was supplied by the Gardner Machine Co.

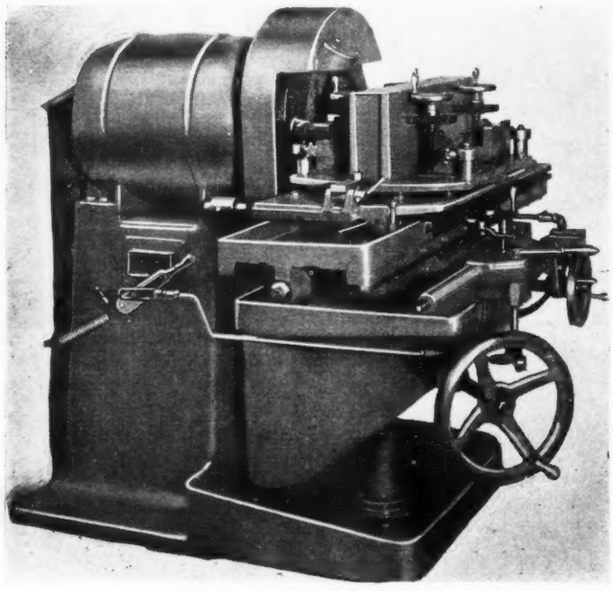


Fig. 32

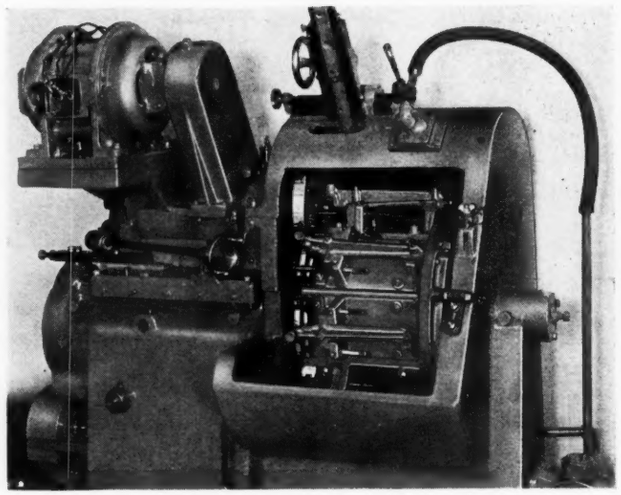


Fig. 31

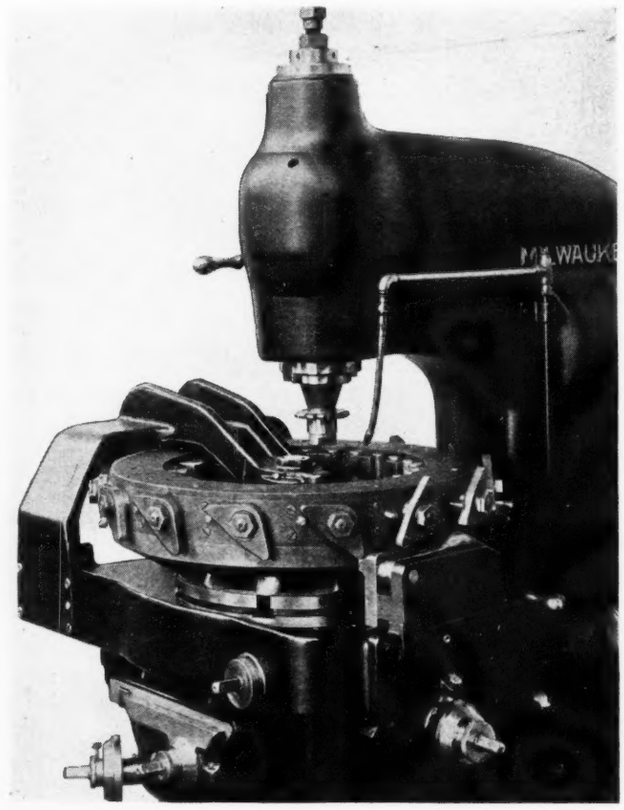


Fig. 33

Special Rotary Fixture

CLEARANCE slots in piston pins are milled in a Kearney & Trecker rotary vertical milling machine equipped with a special rotary fixture (Fig. 33). Each piston pin is set in a hardened ring and automatically clamped with hardened wedge bolts so designed that several sizes of pins can be accommodated by them.

The automatic clamping and unclamping of the pins is accomplished by means of coarse pitch wing nuts which strike against a stop at the right-hand end of the fixture, as shown in the illustration, to clamp the pins, and striking against another stop

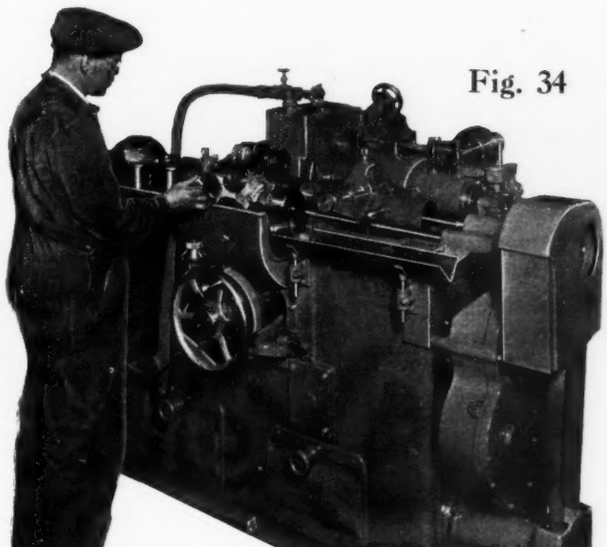


Fig. 34

at the other end to release them. After release, the pins fall into the base of the machine where chips are separated from the cutter coolant which also drains into the base of the machine.

From 900 to 1000 pieces per hour are estimated to be possible to produce with this set-up.

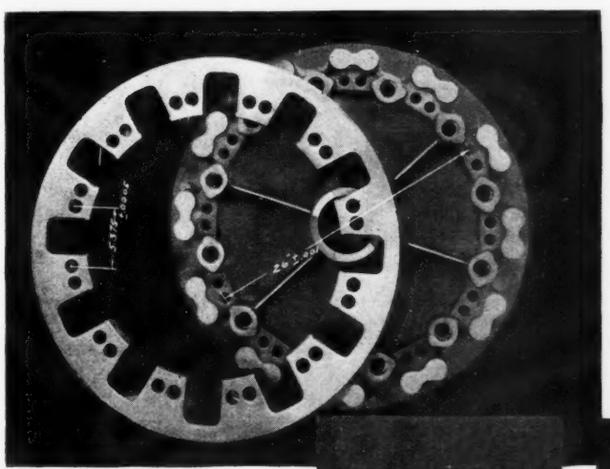


Fig. 35

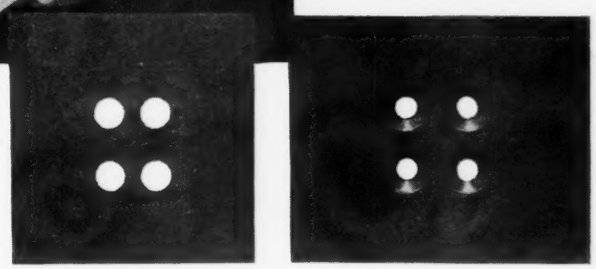


Fig. 36

Grinding Clutch Sleeves

IN the Chicago plant of Borg & Beck Co., an automatic cylindrical grinding machine made by the Arter Grinding Machine Co., is employed to grind the outside diameter of clutch sleeves (Fig. 34). The O.D. must be ground square with the previously ground flange face and concentric with the bore. The diameter must be held within 0.001 in. and the squareness within 0.002 in.

The work-holding fixture indexes four times per minute to give a production of 400 pieces per hour. The special tooling employed includes a combination expanding center with a shoulder on the flange of the headstock. The center engages the straight bore of the clutch 3/8 in. only. This installation reduced the piece rate for the operation from $2 to 40 cents per 100.

This same machine, with different work-holding fixtures and tooling is used to grind by the straight infeed method straight or tapered diameters such as pistons, roller bearings, valve push rods, valve stem guides, piston pins, bushings, shafts and similar work which can be held on centers.

Work is loaded into fixtures by hand or automatically and as the turret indexes to grinding position two live centers automatically pick up and drive the work. The wheel automatically moves in and grinds to size and successive turret movements bring the work to a chute onto which it is automatically discharged.

High Precision Boring

JIG borers made by Pratt & Whitney Co. are adapted to a large variety of high precision boring jobs as the following two instances illustrate. In Fig. 35 is shown a complicated job of high precision boring which is done on a No. 2 jig borer in 88 hours, including set-up time.

There are 24 holes to be bored 1.000 in. diameter and 1 7/8 in. deep. Distance between opposite hole centers must be held within 0.001 in. tolerance from the nominal diameter of 26 in. Twelve more holes are drilled 1.000 in. diameter and 2 3/4 in. deep and are then counterbored 1.625 in. diameter and 1 3/8 in. deep.

The second illustration (Fig. 36) shows a job of locating, drilling, reaming and counterboring a punch and die holder to tolerances of a few ten-thousandths of an inch which is performed complete in 57 min.

Machine of Many Uses

THE numerous and varied applications of modern machine tools to all types of work are well illustrated by examples of how a single type of equipment is being used in various automotive plants. The machine used in every case is a Simplimatic lathe made by Gisholt Machine Co., and the different machining jobs have been made possible simply by altering the tooling and work-holding fixtures.

In Fig. 37 is shown how both ends of a truck axle are machined in a single operation at the plant of the Clark Equipment Co., Buchanan, Mich. Floor-to-floor time for this operation is 6 1/2 min.

The second illustration (Fig. 38) is from the plant of the Dayton Steel Foundry Co., Dayton, Ohio, where a Simplimatic is being employed for the first machining operation on a steel wheel. Floor-to-floor time for this job is also 6 1/2 min.

The Michigan Malleable Iron Co., Detroit, bores and faces the front and back of the hubs and rough and finish turns the rims of malleable iron wheels in a single operation on a Simplimatic lathe (Fig. 39). Floor-to-floor time for these cuts is 3 1/2 min.

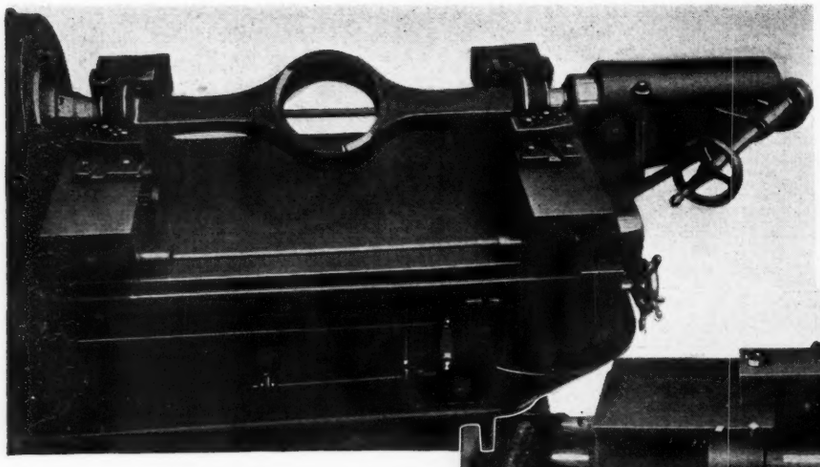


Fig. 37

At the plant of the International Harvester Co., cast-iron differential cases for tractors are machined in Simplimatics. Fig. 40 shows the machine set up for boring straight and

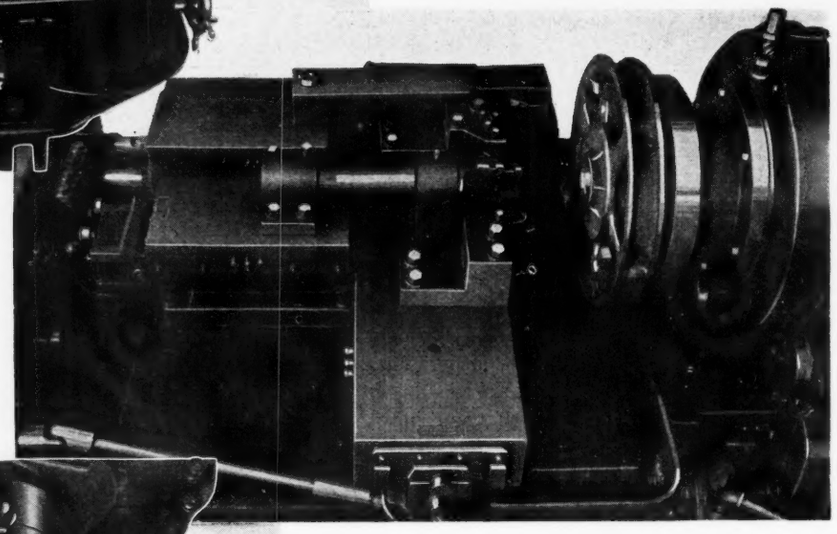


Fig. 38

radius to face and size the shoulder on the cases. Two machines are employed, one for roughing and one for finishing. Operating time for roughing is 3¼ min. and for finishing 2¾ min.

The John Deere Tractor Co., Waterloo, Iowa, employs a Simplimatic (Fig. 41) to turn, face and back face a forged steel ring gear provided with overhead support. Operation time for this job is 3½ min.

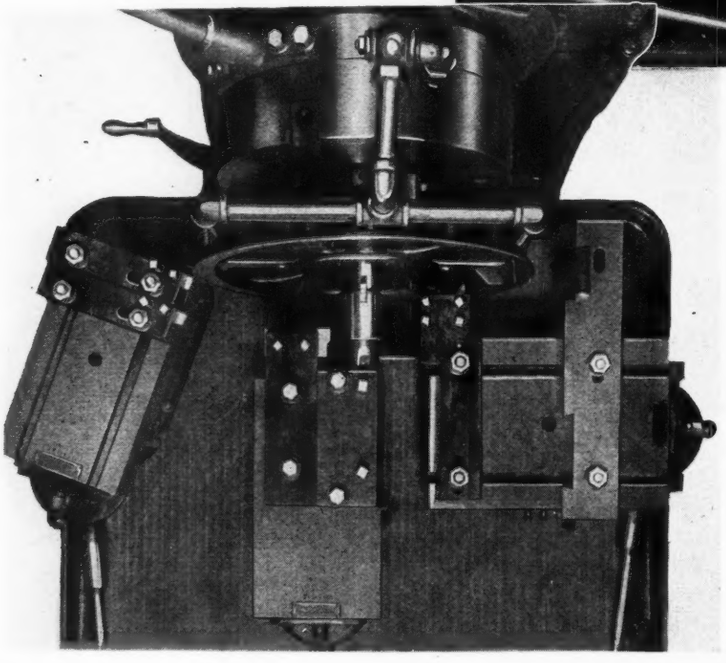


Fig. 39

Turning Crankshafts

ANOTHER illustration of the number of different machining operations which can be performed on a single standard machine tool is given in the adaptations of the 20-in. semi-automatic lathe built by Wickes Bros. While this particular machine has wide adaptations for machining long and heavy pieces, it is used most extensively in the automotive industry for crankshaft work and the following examples are a few

Fig. 41

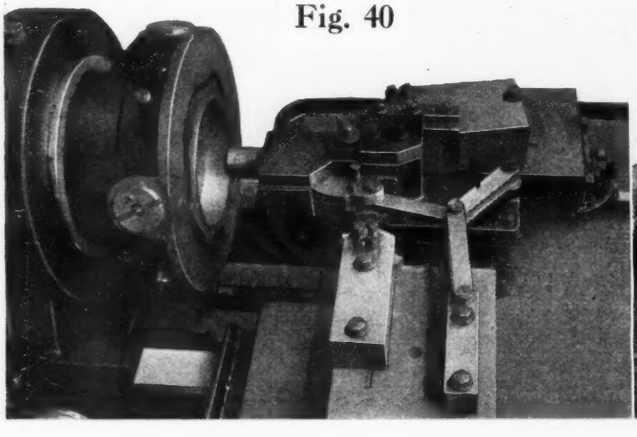
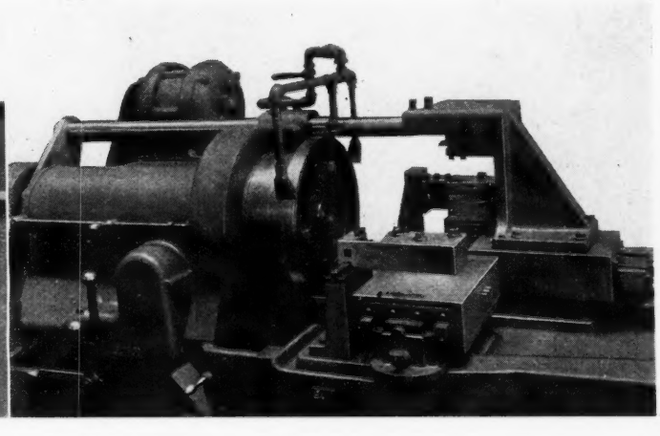


Fig. 40



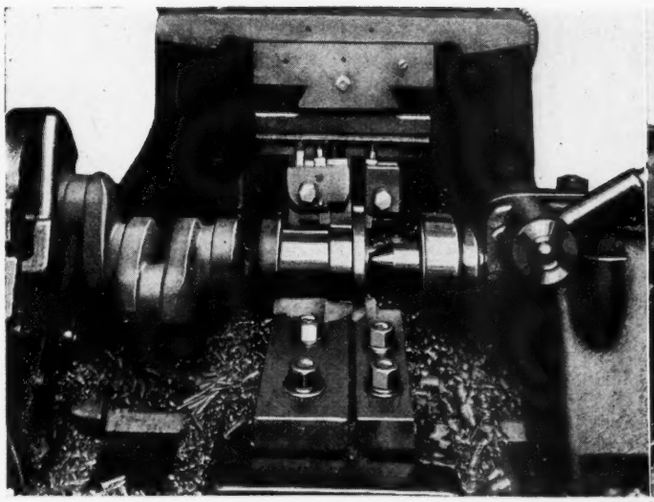


Fig. 42

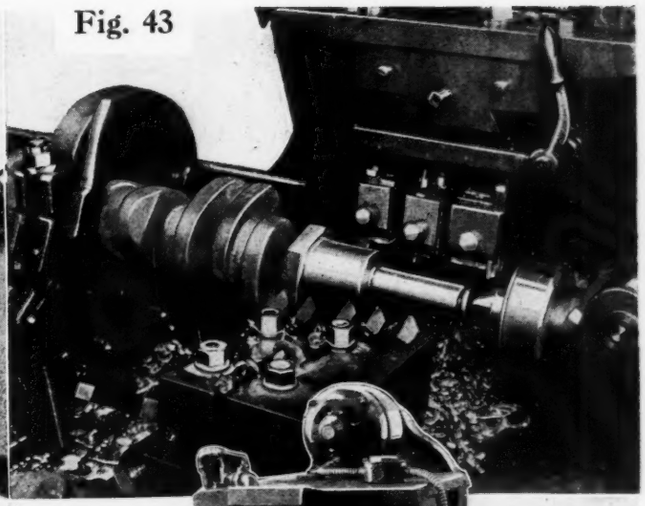


Fig. 43

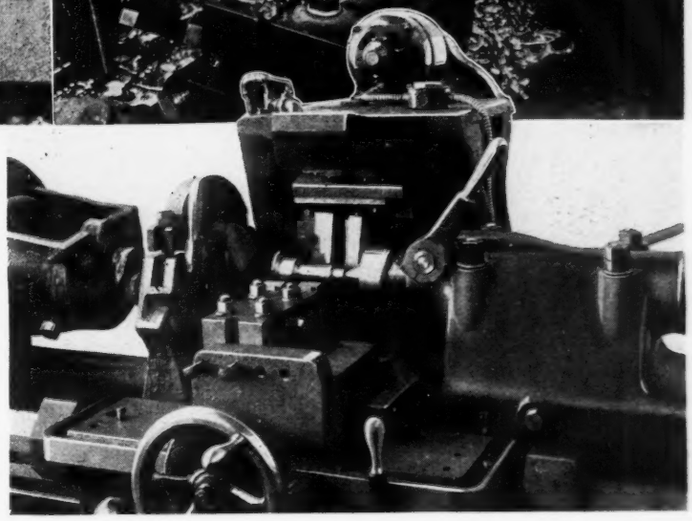


Fig. 44

of the crankshaft operations which can be performed.

The first illustration (Fig. 42) shows a tooling arrangement for cheeking, turning and filleting the rear bearing, straddle facing the flange, turning the outside diameter of the flange and turning the shoulder diameters on a heavy six-throw crankshaft in a single operation. Both front and rear tools advance toward the center simultaneously. From 12 to 15 pieces per hour are produced with this set-up.

The second example (Fig. 43) shows similar work on the front end of a crankshaft. Here the front bearings and end are being cheeked, turned and filleted. Because of the small diameter of the extension, the front tools are made to turn the diameters in a direction parallel to the center line of the lathe. The rear tools are arranged for cheeking, shouldering and necking. Output from this set-up is about the same as from the one previously described.

In Fig. 44 the front end of a crankshaft is again being machined in a Wickes lathe but this time broad tools are employed which complete the job without longitudinal movement of the tools. The entire front end is cheeked and turned with both front and rear tools advancing simultaneously but with only the latter having a longitudinal movement.

About 12 to 15 pieces per hour is the average production from this particular set-up.

In the fourth example (Fig. 45) a Wickes lathe is arranged for machining the flange and oil grooves on a heavy four-throw crankshaft. Both front and rear tools advance without longitudinal movement and output is from 17 to 20 pieces per hour.

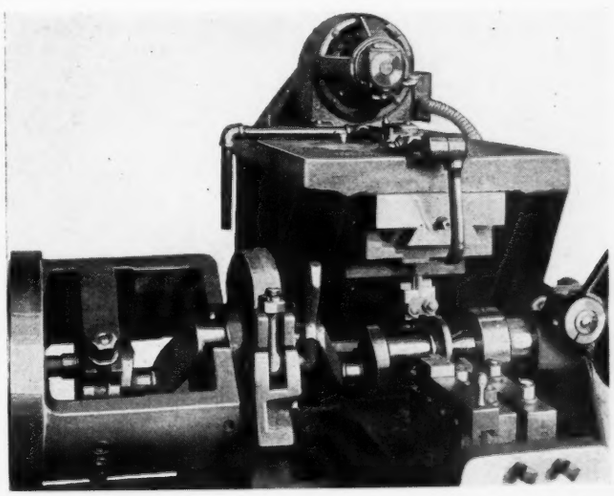


Fig. 45

DISQUALIFICATION for life will be the punishment meted out by the Racing Board of the Automobile Club of Italy on any driver, competitor, team manager or organizer accepting or offering secret commissions, starting money, or indemnities of any kind in connection with automobile races and competitions.

While this is a club rule, it has government backing, for all the leading officials of the Italian Automobile Club are personally appointed by Signor Mussolini and the national club and its affiliated organizations are virtually state controlled. The Racing Board obliges all race promoters to deposit the cash prizes; in some cases these are added to from the funds controlled by the board, and all prize money is paid out by the board, and not by the race promoter. Races and competitors are divided into three classes: those having more than 100,000 liras cash prizes; those with 30,000 to 100,000 liras, and those with less than 30,000 liras. For the last two years the national club has been entrusted with the task of collecting state taxes on automobiles, and by reason of this obliges every Italian motorist to belong to a recognized club.

Electric Welding Becomes

Constantly finding new applications in automotive manufacture. Practical development of projection welding important.

By P. M. HELDT

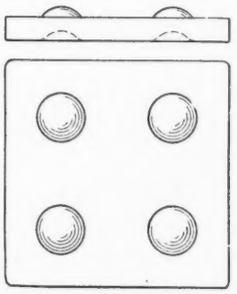


Fig. 1—Form of washer projection-welded to brake shoe

ELECTRIC welding is constantly finding new and more extensive applications in the manufacture of automobiles and of automotive equipment generally. Not only are the various processes being improved, and new methods and adaptations devised, but engineers gradually are learning how to make the best use of the possibilities of welding in connection with their production problems; in the words of the specialists, they are becoming "welding-minded."

Among the chief developments in the application of electric welding to automotive production during the past several years may be mentioned the practical development of projection welding; the very extensive use of flash welding, which is largely taking the place of the original butt welding, and the introduction of automatic arc welding for production of such parts as axle housings and mufflers.

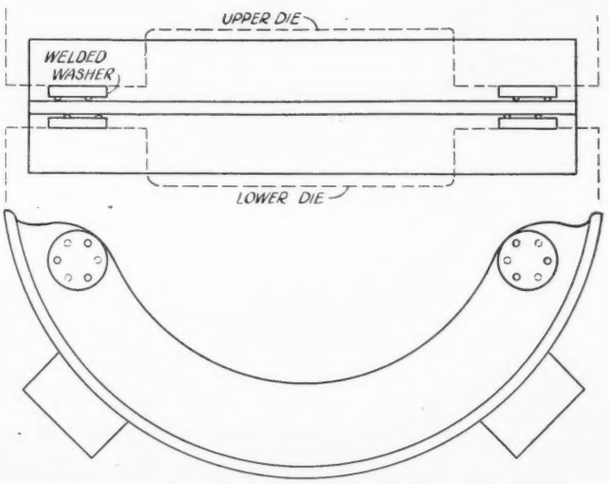


Fig. 2—Projection welding operation on brake shoe

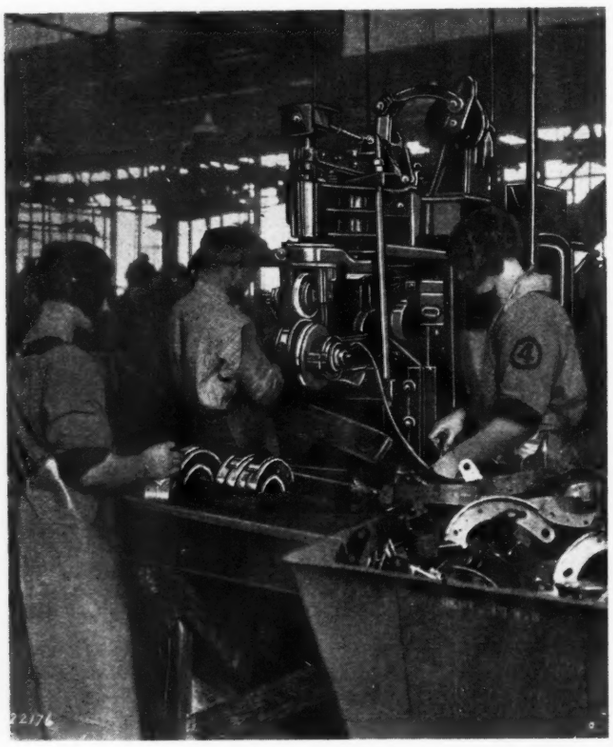


Fig. 3—Welding up Bendix brake shoes in Gibb welder with copper roll electrode

Projection welding is not at all a new process. It would seem that it was one of those inventions that appear ahead of their proper time. When the fabrication of more or less complicated parts of sheet metal in large quantities was as yet a thing of the future there was little need for a process of this character. Projection welding is applied to parts of sheet metal and strip metal and gives substantially the same results as spot-welding. It has the advantage over spot-welding that a number of welds or welded points are produced at one passage of the current, and it is said also to produce a more dependable joint.

In making a projection weld, one of the two parts to be joined is formed with a number of projections of the general form of spherical segments, on one side. This operation, as a rule, is performed at the same time the part is blanked out, so that no extra labor is involved. The parts to be joined are then placed in a suitable fixture, with the sides to be welded facing each other, and placed in a welding machine similar to the ordinary spot welder. The latter, instead of being provided with pointed electrodes, has flat electrodes extending over the whole surface covered by the projections, and current is turned on and pressure applied. There is contact only at the projections, and these and the metal of the other part in contact with them quickly

Important Production Aid

Fig. 4—Flash-welding operation on lower body panels in Fisher Body plant

heat up to welding temperature. The projections then flatten out, and the welds are formed at the same time.

One reason for the claim that the projection process produces a better weld than spot welding is that the original contact area is smaller than the area of the point of the spot welding electrode, and the projection therefore breaks through the layer of oxide more readily. With spot welding there is a good deal of trouble from the points of the electrodes wearing away and requiring redressing, while the electrodes used in projection welding never reach a very high temperature and therefore show no appreciable wear. Besides, as the point of the spot-welding electrode wears away, the contact area becomes larger, the heat generated is less concentrated, and the weld is likely to become imperfect.

Projection welding is used to quite an extent on the Ford Model A. The brake shoes of this car are formed from rolled T-sections, and in order to get enough bearing surface for the anchor pins, washers are projection-welded to opposite sides of the web of the T. These washers, which are stamped from ⅛ in. metal and have four projections formed on them at the same operation, are of the form shown in Fig. 1.

Another part which has six projection-welds on it is a grease baffle. This is a dish-shaped stamping of comparatively light material, and the parts welded to it are short lengths of tubing rolled up of heavy gage sheet metal. These latter are formed with four projections at one end, and a series of six of these nipples are welded to the stamping on a circle and at equal distances. Each part is welded on separately, though the four points on it are welded at once. A demonstration was given the writer by M. L. Eckman, welding superintendent of the Ford Motor Co., of the soundness of these welds. When the bushings were pried off, in each case some of the base metal came off with them, and holes were left in the disk.

Quite a technique is involved in the proper application of projection welding. When the parts to be joined are of very thin stock, the projections must be closely spaced. This is necessary in order that the projections may reach welding heat before they become entirely flattened out, after which there is no longer any concentration of heat. With the projections fairly closely spaced, the pressure required to flatten them out is greater and the period of concentrated heating will be longer.

To insure that all of the projections will weld uniformly, the current flow must be uniform, and this requires uniform pressure at all of them. This puts a limit upon the area and number of projections which can be welded at once. In one operation which was shown the writer in the Ford plant, the lower electrode had a universal—ball and socket—support, so that any slight inaccuracy of alignment would not prevent equal distribution of pressure between all of the projections. W. T. Ober, of the Thomson Electric Welding Co., who presented a paper on the subject before the Allied Tech-

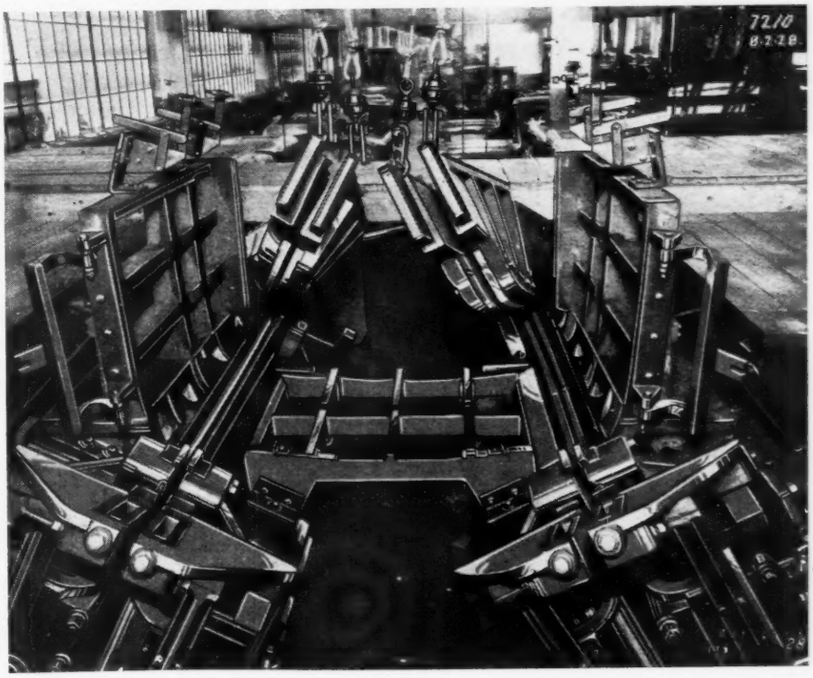


Fig. 5—Showing details of fixture in which body panels are held for flash-welding in Budd plant

nical Societies of Boston in December, 1927, gave the limit of area of sheet metal parts of less than 18-gage, which can be projection-welded in one operation, as 30-35 sq. in., and he also said that individual projections must not be further than 10 in. apart. Up to 12 projections are now welded in one operation. Where no special projections are required, owing to the nature of the parts welded—such as drying oven racks, for instance—as many as 30 welds are made at a time.

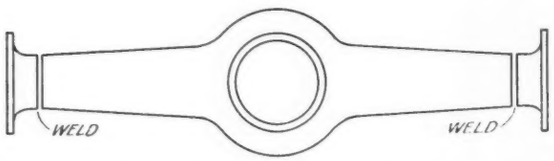


Fig. 6—Welding forged ends to pressed steel axle housings

Fig. 2 shows a welding operation on a brake shoe which is formed cold from rolled T-iron. Metal washers are projection-welded to the web of the T-iron on both side at both ends, to give sufficient bearing area for the anchor pins and roller pins. A pair of washers are first placed on the two heads of the lower die; then the shoe itself is put in place, and finally another pair of washers are placed on top of the web of the shoe, the upper die then being brought down to effect the weld. One operator (a man) and two assistants (girls) are employed on this job, and the production is 400 pieces per hour. The washers are held in shallow depressions in the upper and lower dies, and the shoe itself is located by means of two finished locating surfaces on the machine, so that correct location of the bosses on the shoe is insured automatically.

Body Welding Developments

Great developments have taken place in welding in connection with the manufacture of automobile bodies, and one of the most interesting operations in body production is the flash-welding of the back panel and rear quarter panels, which the writer was privileged to witness at the Mack Avenue plant of the Briggs Mfg. Co. in Detroit. Taylor-Winfield and Federal welding machines are largely used for this operation. The three panels arrive at the rear side of the machine and are put in place on the lower dies. The upper dies, which are pivoted at the rear end, are then swung down into place, their free ends being engaged by toggle levers. These toggles are acted upon by an air cylinder, and the force of the air cylinder plunger, multiplied by the toggle mechanism, presses the dies together very energetically, this having been found necessary in order to insure a uniform weld.

The power required for making this weld is 200 Kva.,

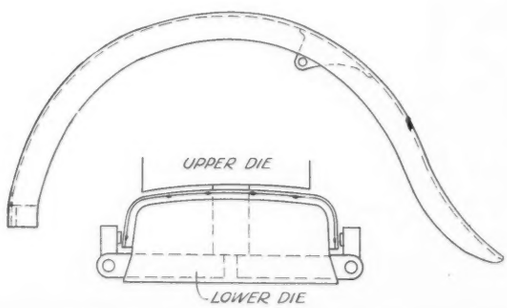


Fig. 7—Welding reinforcement to inside of rear fender

the current remaining on for seven seconds. Most of the time is taken up by loading and unloading the machine, the rate of production being about 40 per hour. From 5/16 in. to 3/8 in. of stock is allowed for the flash. It may be recalled that the principle of flash welding consists in applying current at relatively high voltage, which produces such great heat that the metal at the edges to be joined burns and is thrown off in a shower of sparks. This combustion of the iron helps to heat the metal at some distance away from the edge. The current is then shut off and the edges—at welding heat—are brought together by the machine. This last phase of the operation is known as upsetting the weld.

Dies Made of Copper

The dies for such flash-welding operations are made of copper containing about 1½ per cent of aluminum, which latter constituent is found to close the pores of the copper and make it more resistant to heat. Sometimes the dies have inserts of Elkonite, a copper-tungsten alloy.

The two seams in the rear part of the body are made separately, the current being first switched onto the dies on one side and the parts brought together for upsetting, after which the process is repeated for the other side. Each seam is from 50 to 54 in. long. When

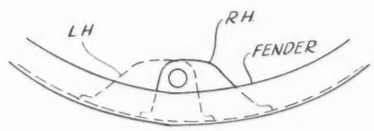


Fig. 8—Welding fastening lug to rear fender, rights and lefts without change in set-up

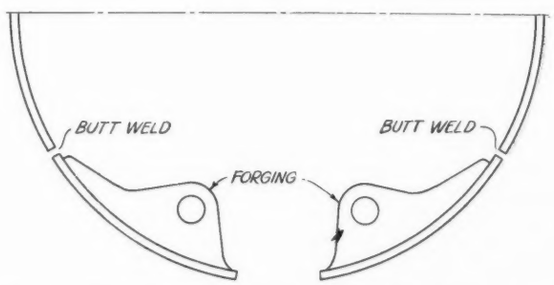


Fig. 9—Welding forged terminals to Ford brake band

both welds have been completed the clamps are loosened and the completed rear section is removed from the machine. The welds are inspected by means of a light passed over them on the rear side, and if the light shows through at any point the defect must be corrected, as holes are not permissible with pyroxylin finish. Repairs are made with the oxy-acetylene torch.

Among welds on heavier stock noticed at the Briggs Mfg. Co. plant was the welding of a rear tire carrier bracket. This is a triangular piece bent up of 3/16 in. material, the ends overlapping. The weld is of the projection type and is made on a Taylor-Winfield machine. There are five projections on one end of the blank. The power required is 100 kw. and the welding operation requires three seconds.

In welding the inside of the door to the outside, the assembly is put on a jig which has a ball and socket support and in consequence can both be turned and swiveled in all directions. The welding operations are performed by a stationary spot welder, the universal jig permitting of bringing the particular points to be welded between the electrodes quickly.

Fig. 4 illustrates a flash welding operation on body panels, the back and rear quarters being welded together in one operation. First the back and one of the rear quarter panels are clamped and welded; then the other rear quarter panel is put in place and it and the back are clamped. The side previously welded is then released and the other side flash-welded. Finally the completed part is removed from the machine. This photograph, which was taken in one of the plants of the Fisher Body Co., clearly shows the spray of sparks produced during the flashing operation.

A Two-Unit Machine

A good idea of the form of fixture required in flash-welding body sections may be obtained from Fig. 5, which is a view of a machine in use at the plant of the Edward G. Budd Mfg. Co., Philadelphia. The machine consists virtually of two welding units assembled on one bedplate. Each unit is equipped with a 200-kw. welding transformer and is capable of welding 0.043 in. stock over a length of 70 in. Undoubtedly the most impressive thing in this photograph is the great rigidity of the fixture for holding the light sheet metal panels. The aggregate pressure on the panels is about 32 tons.

In the following paragraphs are described a number of welding operations on smaller automobile parts, illustrated by sketches, for most of which the writer is indebted to Albert E. Hackett, Detroit representative of the Federal Machine & Welder Co. The illustrations are reproductions of free hand sketches and do not represent the parts accurately, but they will serve to convey a clear idea of the operations.

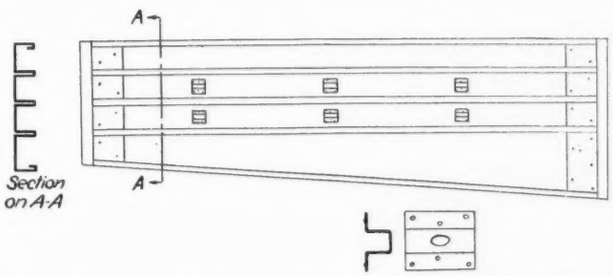


Fig. 10—Welds on Chrysler running board

Fig. 6 illustrates a welding operation on a rear axle housing. The major part of the housing is made of two steel stampings which are seam-welded together in the usual way. The flanges at the ends, which are usually made of malleable castings and riveted on, in this case are made of forgings and welded to the center section by means of a Federal double-ended butt welder. This practice is followed at Chrysler and Dodge plants.

Fastening Fender Brackets

Projection welding has found application also in fastening reinforcements and brackets to fenders. Two such operations are illustrated in Figs. 7 and 8. A reinforcement is welded to the inside of the rear fender at the front end where it fastens to the running board. In this case the projections are not all in the same plane, and the operation therefore requires somewhat different equipment from that previously described. The fender at this end is virtually of channel form, and in addition to four or five projections on the web of the channel, there is one on each flange. The lower die in the welding operation is on the inside of the channel, while the upper die comes down on top of it. There are two auxiliary dies at the ends of the lower die. These are in the form of bell cranks and carry points which when the upper die is lowered, press laterally against the projections in the flanges of the channel, the horizontal arms of the bell cranks being acted upon by a projection of the upper die. A Federal 612-B projection welder is used for this operation.

The other operation on the fender consists in welding a bracket or lug to one flange by which it is fastened to the body. Whereas the form of the reinforcements at the front end is the same for right and left fenders, these lugs are different for fenders for opposite sides of the car, and a special die was developed which permits of running left and righ fenders through the welding machine without changing any part of it. As shown in Fig. 8, two gage pins are provided on the die, one for right and the other for left-hand fenders. The production on both of these operations is 250 per hour.

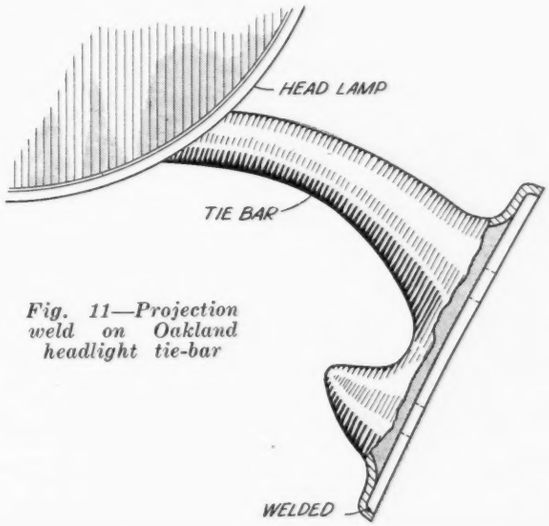


Fig. 11—Projection weld on Oakland headlight tie-bar

The parking brake on the Ford Model A consists of a band of strip steel, $\frac{1}{8}$ in. by $1\frac{1}{4}$ in. which has forged terminals welded to it, these terminals containing eyes for the expanding mechanism. The operation is performed in a No. 60 Federal butt welder and 300 bands are welded up per hour. The operation of the machine is entirely automatic, the machine being started by means of a treadle. Following is the sequence of operations during a cycle: The stock is clamped, the welding circuit closed, the motor started, the stock flashed, the welding circuit opened, the weld upset, the motor stopped, the work released, and the machine set for the next weld.

A very interesting projection welding operation that has been developed recently is that on the Chrysler running board. This running board is bent up of flat stock which is so folded (see Fig. 10) as to form ribs on the under side. The "board" is not of uniform width but

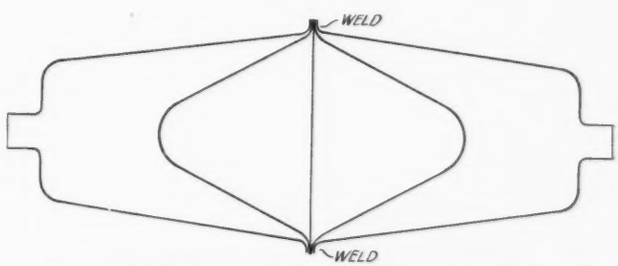


Fig. 12—Muffler made up of sheet-metal units, are welded

becomes wider toward the front, to make up for the decrease in the width of the frame. At the ends these "boards" are reinforced by angles of No. 16-gage steel, one side of which is slotted so as to pass over the ribs. This side lies directly underneath the flat top of the board and is united to it by projection welding. After these end reinforcements are welded on, six clips are projection-welded to the under side, between ribs, for bolting the running board to its three pressed steel brackets. Each of these clips is welded separately at a time. After the first weld has been made the part is moved automatically into a position where the welding dies are above and below the other clip for the same bracket; then the part is moved endwise to the position of the corresponding clip for the next bracket, and so on.

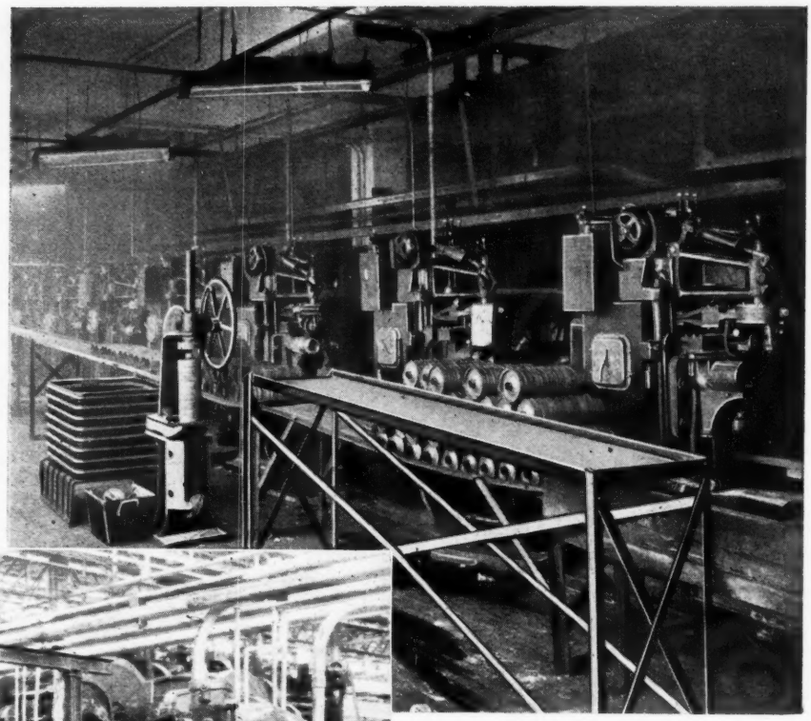


Fig. 13 (right)—Welding operation on mufflers in Dodge plant (Gibb welder)

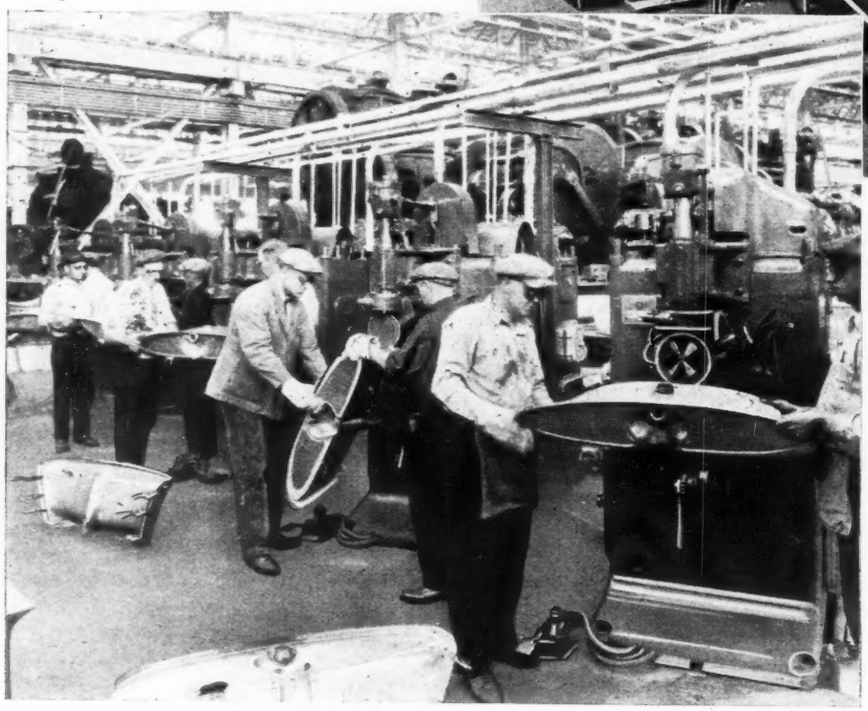


Fig. 14 (left)—Welding of pressed steel fuel tank in Ford plant

On the Oakland car this year there is a tie rod for the headlights that is fastened to the fender brackets in a neat way. The end of the tie bar, which is of sheet stock, spreads out to have a base of considerable area on the fender, and it has an upward depression formed in it, large enough to take a bolt head. A piece of flat stock with a hole in it and the bolt inserted is then welded to the end of the tie bar in a Federal full automatic welding machine, at the rate of 200 per hour. The welds are projection welds and run around three sides of the base of the tie bar.

Reference has been made already to the growing use of automatic arc welding in automobile construction. One of the parts to which this process is applied is the muffler. Mufflers are increasingly being made of sheet steel stampings and deep drawings, and one method of assembling these parts is by a single arc weld around the circumference at about the middle of the length. This is illustrated diagrammatically in Fig. 12. This gives a muffler that is light, strong and cheap to manufacture, and its efficiency, of course, depends chiefly on its proportions. Fig. 13 illustrates the use of arc welders in welding circular seams on mufflers in the Dodge plant.

Automatic seam welding is employed also on the gasoline tank of the Ford Model A. This tank, which is back of the engine hood, also constitutes the cowl and the instrument board, and has a rather intricate shape. It is made of pressings of terne plate (lead-coated steel), which are welded together by the automatic arc welding process. The welds necessarily must be very reliable to prevent leaks developing, and owing to the location of the tank it is also important that in case of mechanical injury to it the seams should not open up. In making the weld, the flanges of the stampings are passed between copper rolls forming the electrodes, at the rate of 40 in. per minute, the upper roll being driven while the lower roll is an idler. The flow of current is not continuous, there being a surge at regular intervals, and the heat produced thereby, together with the pressure of the rolls, forms the weld. The production of a perfect weld in parts like the one under discussion depends upon many factors which need not be enumerated here. Faults in welding are guarded against by filling the tanks with air under pressure and submerging them in water, when bubbles rising will quick-

ly indicate any leaks. The automatic welding operation on these tanks is illustrated in Fig. 14.

Rear axle housings have long been made of sheet-steel pressings welded together. The first pressed-steel axle housings were welded by the acetylene torch and later the hand arc welding process was introduced for the purpose. Still later, to speed up production, special butt welding machines were designed and installed in the production and assembly line with the presses, etc. This was a big step in advance from the standpoint of speed of production, as practically 1000 axles could be passed along the line per day. But the process had its disadvantages. It is naturally very difficult to effect a uniform weld over so large an area as that of the abutting surface of axle housing halves, if the conditions are not just right, and, besides, the enormous current draw when the dies are closed creates a disturbance in the lines supplying the electric energy.

Automatic Arc System

In some of the latest installations for axle welding the automatic arc system has been adopted. The Westinghouse Electric & Mfg. Co. recently installed ten automatic arc welding machines in one Detroit plant for welding together the rear axle housing halves. These are provided with the automatic arc welding heads developed by the Westinghous company.

The machine comprises a large stationary base, with a cross rail at the back on which two automatic arcs are mounted. These arc heads are connected to a lead screw so that they can be made to travel along the cross rail in opposite directions. The lead screws have right and left hand threads over half of their lengths.

In front of the cross rail there is a sliding bed on which is mounted a large chuck which clamps the halves of the housing together, with the abutting edges in accurate alignment. The chuck is air-operated and so designed that it contacts with the axle housing over a small surface only. The chuck comprises two plugs which are automatically pushed into the ends of the axle housing to give a "backing-up" member, so that the start and finish of the weld at the ends of the housing will be satisfactory, and will clean up during subsequent machining operations.

The large chuck can be turned over 180 deg., so after one side is welded, the framework of the jig is pulled to the extreme forward position, where the jig can be rotated and then pushed under the automatic welding heads again.

Operation Starts at Center

In operation, welding starts at the center of the housing and proceeds toward both ends, where the operation is automatically stopped by limit switches. The operator then pulls the movable carriage forward, turns the jig over and then pushes it under the automatic welding heads, whereupon he again presses a starting button, which causes the two automatic heads to commence welding at the very ends of the housing and work toward the center opening, where welding is again automatically stopped by the limit switches.

The entire operation is automatically controlled, the operator merely throwing the switches controlling the air valves which operate the jaw clutches, and pushing the starting button which starts the welding and travel cycle. Groups of two machines are placed face to face, so that one operator can tend to both. The welding time is just about sufficient to enable the operator to load and unload the second machine before the housing in the first machine is completed. One operator on two machines turns out 60 housings per hour, and the writer understands that the production has actually run as high as 78 housings per hour.

Current for the welding operation is furnished by a 500-amp. constant-voltage motor-generator set for each welding head. The entire control is by means of contactors which in turn are controlled by push buttons mounted in suitable locations on the welding machine.

Manganese in Welding Rod

THE effect of manganese in welding rod is discussed in a recent bulletin of Fusion Welding Corp. Manganese is always present in commercial steels in quantities varying from little more than a trace to 14 per cent. From the steel making standpoint, 0.30 to 0.40 per cent is ideal in most mild steels. Manganese is almost invariably present in iron ore, so that from 0.15 to 0.25 per cent appears in the steel from this source. If less than this is required in the finished product, it must be removed in the steel making process and, if more, it must be added to the molten steel in the form of ferro-manganese. It helps substantially to make sound steel to add some ferro-manganese, and that is why most steels have a somewhat higher content than which comes from the iron ore. All this means that the cheapest steel, so far as costs of manganese is concerned, contains usually from 0.25 to 0.40 per cent. Above this limit, manganese must be added and, below it, removed. It generally costs more to remove it than to add it, unless the addition required is over 1.0 per cent.

Manganese not only alloys with iron readily in all proportions, but also combines chemically with other elements usually found in steel, forming, for example, with carbon, manganese carbide and, with sulphur, manganese sulphide, both comparatively hard substances.

It is very difficult to study or describe the effects on welding of any single element, such as manganese, in welding rod, because there are usually a number of such elements present. Manganese, for example, acts in many respects like carbon, and it is not easy to always determine accurately which is responsible for a certain result.

Both carbon and manganese can be classed as reducing agents for iron, by which is meant that at high temperatures they will take oxygen away from iron oxide, leaving metallic iron and form oxides of carbon and manganese. This is the sort of action which goes on in the blast furnace, coke being the form of carbon used, and carbon monoxide gas being given off. Manganese will produce this blast furnace action in the weld puddle, helping to clear it of oxides. Extremely high temperatures are required to vaporize or make a gas of the manganese oxide. Most of this oxide floats to the top of the weld puddle as a heavy slag. Some gas, however, is formed and this causes manganese boiling, which can be recognized because it resembles the slow, heaving action of boiling molasses instead of the more snappy boil produced by carbon oxides, which are all gases.

On high speed welding work where little opportunity is given the operator to puddle his metal, an excess of maganese is apt to cause blowholes, for much the same reason as carbon. Especially for production welding by the gas process on thin mild steel sheets, a rod low in manganese should be used. This is not so necessary with metallic arc or carbon arc work, because of the higher temperatures which make the weld metal more fluid, allowing the gas to escape.

Some of Those Who Will Take

Leading Production Problems

THE annual Production Meeting of the Society of Automotive Engineers, which is to be held in the Book Cadillac Hotel, Detroit, beginning Thursday, Nov. 22, will be of more than usual interest to all production men. The program covers some of the most important problems confronting production executives today and the men who are to present papers are well qualified not only to interpret developments in production technique already disclosed but also to forecast future possibilities in manufacturing activities.

Of especial interest will be the report of the Production Standards Committee, as this will deal with a comparatively new activity of the Section, but one which, developed to its logical conclusion, bids fair to be one of the most important contributions ever made to the

S. A. E. Production

Thursday

10 A. M.—OPENING SESSION
E. P. BLANCHARD, *Chairman*

Work of Subcommittee on Process and Equipment—Chairman G. W. BLACKINTON (Report)

How the Ford Motor Company Gets its Phenomenally Low Production Costs—JOHN YOUNGER, Ohio State University

Accounting for Depreciation as a Production Cost—L. A. BARON, Comptroller, Stutz Motor Car Co.

Work of Subcommittee on Production Expense—Chairman H. P. HARRISON (Report)

2 P. M.—AFTERNOON SESSION
P. L. TENNEY, *Chairman*

Work of Production Standards Subcommittee—Chairman L. F. MAURER, (Report)

The Barnes Gear Shaver Process—H. D. TANNER, Pratt & Whitney Co.

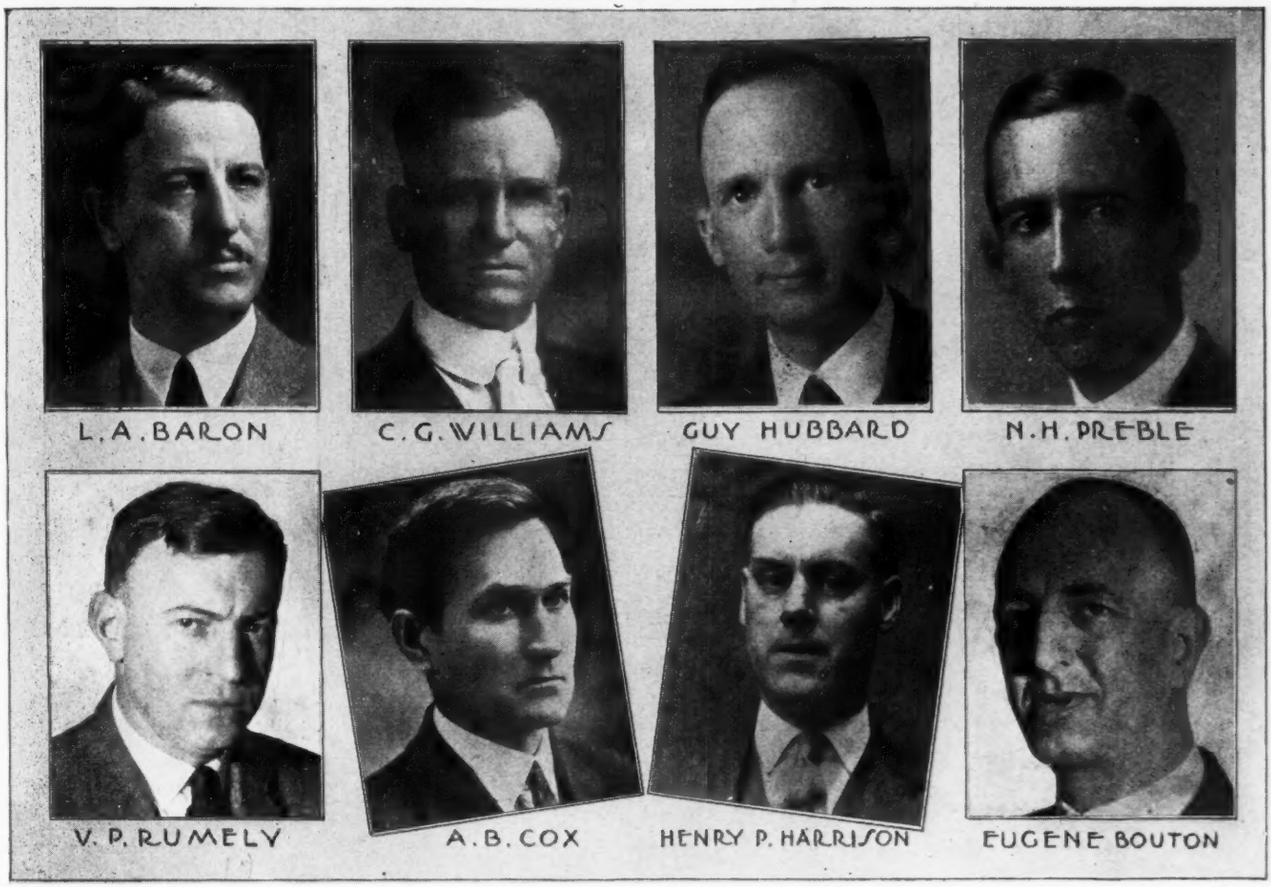
Integral-Contact Gearing—A. B. COX, Consulting Engineer

Honing Progress—C. G. WILLIAMS, Barnes Drill Co.

6:30 P. M.—DETROIT SECTION PRODUCTION DINNER

Production Address by K. T. KELLER, Vice-President in Charge of Manufacturing, Chrysler Corp.

Part in Coming Production Meeting



Slated for S. A. E. Diagnosis

Meeting Program

Friday

10 A. M.—MATERIAL HANDLING SESSION

V. P. RUMELY, *Chairman*

Work of Material Handling Subcommittee—Chairman V. P. RUMELY

Assembly Plant Layout for Material Handling—N. H. PREBLE, Mechanical Handling Systems, Inc.

Selection of Conveyor Power Units—C. E. BROOME, Gears and Forging Co.

Possibilities and Limitations of Conveyor Chain Curvature—J. B. WEBB, J. B. Webb Co.

2 P. M.—POWER-TRANSMISSION SESSION

Power Transmission Engineering as Affecting Production and Cost—W. W. NICHOLS, D. P. Brown & Co.

Chain Drives and Their Industrial Applications—A. C. WOODBURY, Society of Automotive Engineers.

Prepared Discussion on other Types of Drive and on Actual Savings Obtained by Proper Belting by Production Engineers.

8 P. M.—EVENING SESSION

GUY HUBBARD, *Chairman*

Production Meetings of the Society—GUY HUBBARD (Report)

The Relation of Time-Study to Manufacturing—L. W. HASKELL, Dodge Brothers, Inc.

Work of Time-Study Subcommittee—Chairman EUGENE BOUTON

Interpretation of Production Records—PAUL GEYSER, General Motors Truck Co.

art of production. Another feature of the meeting will be the dinner on Thursday night at which K. T. Keller, vice-president in charge of manufacturing, Chrysler Corp., will speak.

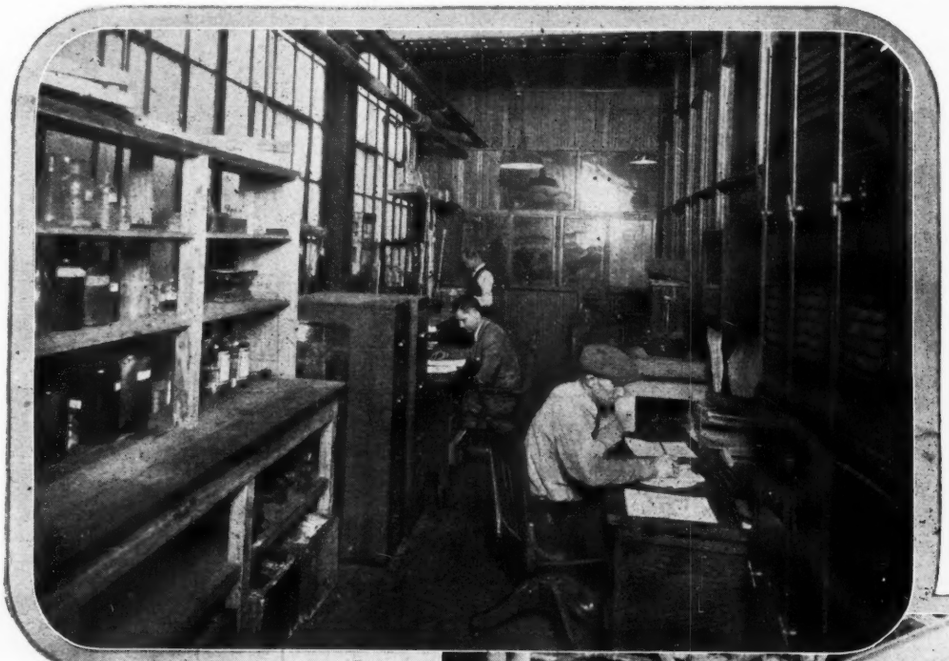
The dinner will be given by the Detroit Section of the S.A.E., the Section acting as host to all out-of-town members of the Society attending the Production meeting.

Considerable interest also is being shown in an outline of the activities of the S.A.E. Production Committee which will be given by Chairman E. P. Blanchard.

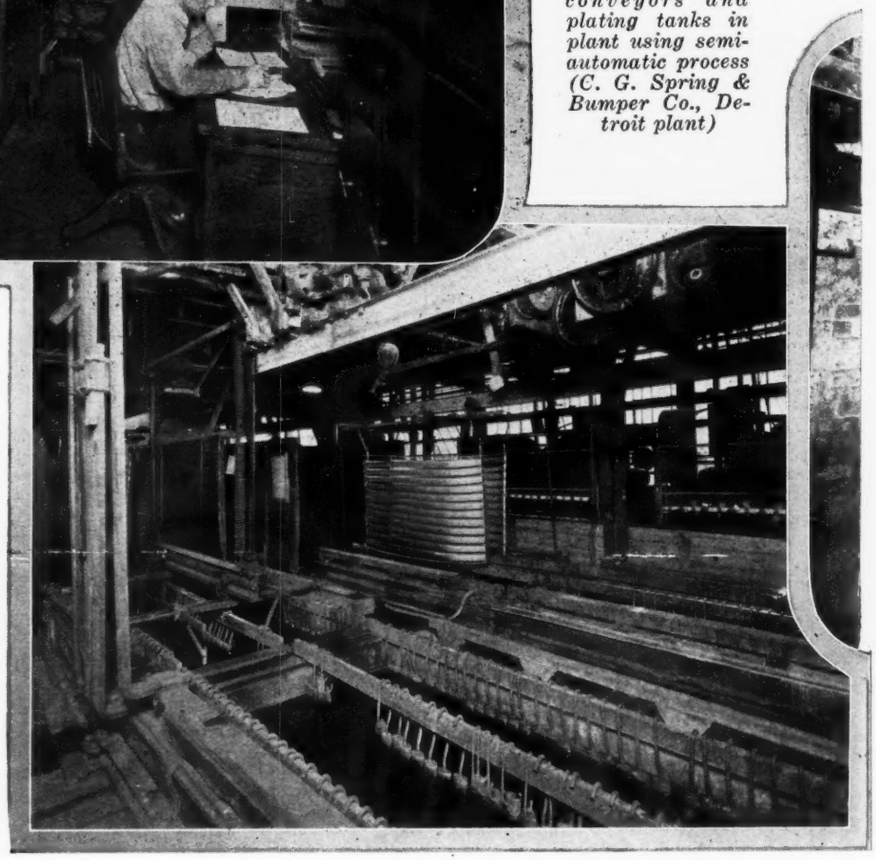
As usual, *Automotive Industries* will have ample staff representation at the meeting and a full report, not only of formal papers but of the invaluable formal and informal discussions as well, will be published in the issue of Dec. 1.

Automotive Interest Stimulated

By
Edmund B. Neil



Typical laboratory where tests of plated coatings and control of solutions and processes are carried out



General view of conveyors and plating tanks in plant using semi-automatic process (C. G. Spring & Bumper Co., Detroit plant)

THE advent of chromium-plating has served to stimulate automotive interest in the whole field of electroplating to a degree that may be considered remarkable, since the time is not far past when electroplating was regarded more as an "art" than as an automotive production process and was accorded little attention in the production departments of the vehicle factories.

However, while the aura of secrecy which formerly cloaked the experience of electroplaters has been generally dispelled, there has grown up, as is usual when development is rapid, a conflict of theories and practices and the new is engaged in a spirited contest with the old.

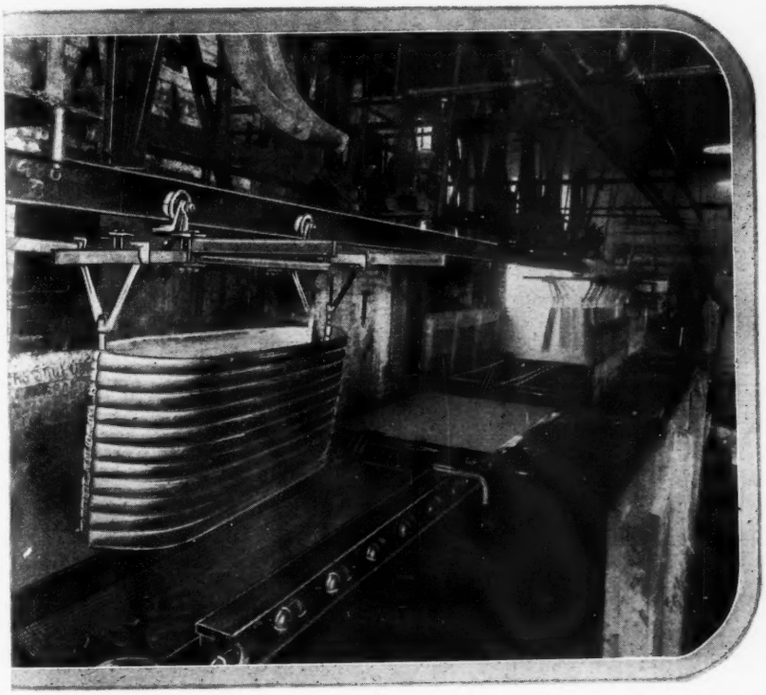
Chromium-plating was directly responsible for forcing further investigation of the chemistry of electroplating and of encouraging experimental advance in the various processes involved. This in turn has resulted in even greater improvements in copper and nickel-plating and in lowering the cost of plating on soft steels and other ferrous alloys.

As chromium-plating is particularly applicable where enhanced appearance is desired, it is to be expected that this aspect of the subject will continue to command the major share of attention. But the point must not be lost sight of that there are certain outstanding factors differentiating between plating for appearance and for the preservation of the underlying materials or surfaces, and that chromium-plating has not been successively applied unless the better appearance is lasting.

Where appearance is essential, the more elaborate buffing and polishing operations, sometimes combined with scratch brushing and other methods of smoothing or preparing the undersurface, are involved; and as the desire for variety of finish, for obtaining matching or contrasting coatings increases, it is to be expected that the use of these more extensive operations will in-

in *E*lectroplating *P*rocesses

Advent of chromium-plating has resulted in rapid development of art in all its phases. Cost of plating lower on soft steels and other ferrous alloys.



Chromium-plating tank showing wire screen anodes used in plating bumpers and brackets

crease along with the general increase in the amount of plating now found on any of the newer vehicles. Body hardware, interior fittings, windshield parts and many others, along with those heretofore nickel-plated, lend themselves to the more decorative aspects involved in the most advanced electroplating practice.

Electroplating in automotive plants when considered from a production standpoint may be divided into three general classes:

1. What may be termed the "full or semi-automatic" plating of large quantities of similar parts, such as bumpers, brackets, bolt heads, lamp shells, etc., wherein little if any manual labor is required to transfer the parts from one tank to another;

2. The "small production" plant where similar parts are regularly handled but in much smaller quantities, and

3. The "job shop" in which a wide variety of parts are plated daily and the diversification of work does not justify the use of conveyors and other material handling devices.

One of the problems of companies in the first group has been to so time the sequence of "dips," "washes," "sprays" and other factors that a smooth flow of material will take place as the parts pass from one bath to another. While this has been accomplished, and in later installations the conveyors carry the plated parts with a surprising regularity through the entire process, in some of the older plants "extra tanks" may be seen along the plating line which were installed to care for any possible irregularities in calculated results and to permit of variations in the process if other parts were to be plated or changes in method were to be made.

The following is a tabulation of the operations carried out in copper, nickel and chromium-plating bumpers, in a plant which incidentally uses what has been termed the "high current" method of applying the plate.

Operation	Time, Remarks, Etc.
1. Polish of heat treated bar. (Hardened 1095 S.A.E. steel)	
2. Bars racked up and cleaned in hot and slightly agitated electrolytic solution. (Wyandotte cleaner)	2 Tanks. Total time 3 min.
3. Spray or dip rinse in water.	
4. Acid dip.	4 or 5 sec.
5. Rinse and scrub with fine pumice. (Hand scrub and inspection)	
6. Spray rinse.	
7. Non-electrolytic acid dip (muriatic acid)	
8. Spray rinse.	
9. Flash nickel-plate.	5½ min. @ 40 amp./sq. ft., or 220 amp.-min.
10. Spray rinse.	
11. Copper-plate.	5½ min. @ 60 amp./sq. ft. or 330 amp.-min.
12. Spray rinse.	
13. Final nickel-plate.	Operation carried out in 2 tanks, 5½ min. each @ 40 amp./sq. ft. Total 11 min. and 990 amp.-min.
14. Spray rinse.	
15. Hot water rinse.	
16. Buff. inspection.	This is final operation when bumper bars are to be nickel plated only.

When parts are to be chromium plated the following operations take place:

17. Electrolytic cleaning.	2 min.
18. Spray rinse.	
19. Acid dip.	
20. Chromium-plate.	2 min. @ 150 amp./sq. ft. Temperature of bath 118 deg. Fahr. Bath highly agitated and screen anodes used.
21. Dip rinse for recovery of "carry-over" solution.	
23. Spray rinse.	
24. Hot water rinse.	

From the above it will be noted that there are several departures in this process from customary practice. One of the most noticeable is that nickel is first deposited upon the steel surface rather than copper. It is also noteworthy that the only buffing or polishing operation after the usual one performed on the uncoated steel surface is that given the final nickel coat. This is considered sufficient for bumpers since a highly finished surface is not desired and the elimination of buffing along with the high currents used gives a thicker coating than otherwise. This in turn is intended to result in greater resistance to rusting and a material reduction in plating costs, yet at the same time providing ample resistance to tarnishing and rusting.

As an example of the operations performed when the quantity of parts is smaller, those carried out in one of the automobile plants are given. In this plant such parts as the rims for wire wheels, spare wheel clamp brackets and similar pieces for its special models are regularly plated.

Operation	Time, Remarks, Etc.
1. Polish metal surface.	One or two wheels, depending upon nature of piece.
2. Electrolytic cleansing.	Tri-sodium phosphate and soda ash bath. (S. K. cleaner.)
3. Still tank wash.	
4. Pumice scrub.	
5. Still tank wash.	
6. Cyanide copper-plate.	10 min. @ 15 amp./sq. ft. Temp. of bath 120 to 125 deg. Fahr. or over.
7. Hot water rinse.	

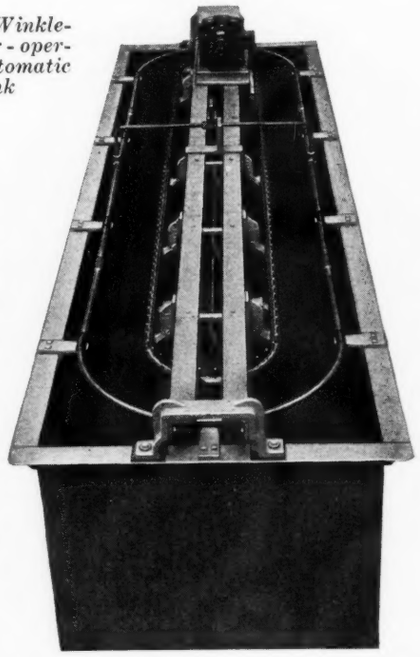
After operation No. 7, the parts are sometimes transferred to an acid copper bath for 15 min., then rinsed in cold and hot water. This operation is carried out on hood handles and similar parts subject to severe treatment in service. The acid copper bath is kept as cold as possible.

8. "Coloring" operation.	One wheel, or none if copper has a high luster.
9. Electrolytic cleaning as in No. 2.	
10. Polish.	Hanson - VanWinkle - Munning 3C Compound.
11. Cold rinse.	

Following operation No. 11, special parts and those having a shape or section poorly adapted to plating are given a cyanide copper strike before operation.

12. Nickel-plate.	Watt's solution. 20 min. @ 10 amps./sq. ft. or 200 amp. min. Temp. of bath 100 to 105 deg. F.
13. Cold and hot rinses.	
14. Polish. Cloth wheel and buff.	F. G. Stevens polishing compound.
15. Wipe and (if specified) follow with	
16. Chromium-plate.	No intermediate cleaning or rinses between nickel and chromium plate. Modified Sargeant solution, with no chromic carbonate and chromic and sulphuric acids only.

Here again differences from previously established practices may be noted. This is one of a very few companies using an acid copper bath on some parts. The elimination of cleaning or rinsing between nickel and chromium plating operations also is believed unusual, except where special compounds are used in the buffing or polishing operations at this point in the process.



Hanson-Van Winkle-Munning motor-operated semi-automatic plating tank

It is in plants doing a wide variety of work that great dependence is placed upon the experience and observation of the electroplater, and his services are considered indispensable, although it is not to be assumed from this statement that electroplating experience is not highly desirable even where a strict metallurgical control is exerted over all operations performed in manufacturing the product. At the same time it is obvious that where several thousand parts of two or three hundred kinds are plated monthly the ability to maintain accurate current control becomes less, or involves the introduction of expense for experimental or chemical tests hardly worth the cost except where a large number of duplicate parts are to be plated.

With this in mind, the more essential experiences and exceptional practices in some of these shops and in a number of automobile plants may be summarized as follows:

1. Pits in iron and steel castings are a frequent cause of failure, hence all suspicious surfaces are ground, filed or smoothed up, even where high finish is not desired.

2. Cleaning of parts, while important, is not much more so for chromium-plating than for nickel-plating only. However, correct preparation of the surface is very essential. Where a high finish is desired grinding and turning leave tool marks which must be removed, particularly on decorative parts. On the other hand, chrome-plating of mechanical pieces may represent a reverse condition so that they may have to be roughened to give the plate a surface to which to adhere.

3. A completely saponified tripoli containing no paraffin has been found a satisfactory medium for polishing operations, particularly where chromium is plated over nickel without intermediate cleaning for removal of the polishing compound. Proper cleaning at this point has been one of the problems of chrome-plating.

4. A difficulty affecting the holding ability of the chrome plate results from improper control of the nickel bath. Control of the nickel solution and its maintenance on the slightly acid side is essential. If not properly controlled, the hydrogen developed during chrome plating will penetrate the nickel, making it brittle with resultant flaking. This may even be the case with nickel, which, unless chrome-plated, would be considered satisfactory. Copper plating must also be better for about the same reason.

Hanson-Van Winkle-Munning double Bakelite barrel plating machine, motor operated

5. There are but few impurities which from the standpoint of current density and temperature will have a detrimental effect on the chrome bath, and it is remarkable what a large amount of various impurities can be included without spoiling the process.

6. Of the impurities which do have a bad effect, it has been stated that the major ones are sulphates, chlorides and nitrates. Sulphates are very frequently used in chromium plating, but the amount must be carefully controlled as an overdose will stop the process. Chlorides have been used to a limited extent but require an even closer control. Nitrates may be considered always harmful.

7. While agitation of the chrome bath is not general, it is necessary when plating the inside of small bores where the metallic solution must be constantly renewed in order to obtain a uniform plate of homogeneous characteristics. In the few cases where agitation is used one of the major ideas is to reduce the speed of travel of the atomic hydrogen liberated during the chrome-plating operation, and to reduce fuming of the bath. Too much agitation is likely to remove the cathode film and stop the plating action entirely, since in chrome plating it is understood that the acid must first be reduced to a lower valency (cathode film).

8. "Stop-off" lacquer (Berry Orange) may be used where a plated surface is not desired. This material will withstand the effects of plating solutions. It may also be used as a coating on hooks and suspension brackets to reduce the current consumed and prevent waste.

9. Use of rubber "corks" or filler plugs permits of chromium-plating clear up to the edge of holes or recesses, and of course prevents depositing any metal on the inside surface of hole.

10. One of the advantages of chrome-plating is that, in contrast with nickel-plating, the piece may be removed during deposition of the metal without injuring the coating. This in turn permits of plating pieces too long to be entirely immersed at one time by plating each end separately.

11. While parts may be polished after chrome-plating, due to the hardness of the coating this is an expensive operation and is done only to remove water marks from the surface.

12. Boric acid is used to clean both chromium and nickel baths, and to balance acid and nickel from anodes. Throwing it into the solution and permitting it to dissolve and distribute itself throughout the bath through natural agitation has been found sufficient.

There are many factors relating to the correct application of chromium-plating. It may be stated that chromium-plating can in no sense be considered as a substitute for either copper or nickel-plating, at least under conditions existing at the present time.

Experience has shown that where, for instance, the preliminary nickel coating was abolished, rust soon set in. This is apparently due to the porosity of the chromium coat and shows that in so far as resistance to rust is concerned, the undercoatings of copper and nickel must be as well or even better applied if a lasting chromium plate is to result. Naturally this statement does not apply to the direct plating of chromium on steel in reclaiming worn gages, tools, dies, etc., a subject differing appreciably from plating for rust resistance and appearance and one which requires separate consideration.

Coatings Are Thin

In all cases the thickness of the chrome-plate is extremely small (around 0.000015 in.). Even much thinner coatings than this will give tarnish resistance, but when thicknesses of the order given are used, increased resistance to rust has been noted. At the same time it has been found that when the coating is too thick it is

as bad as having one too thin, the most satisfactory range, according to Prof. Edwin M. Baker, being within the limits of 0.00001 to 0.00002 in. Since determination of thicknesses deposited in commercial or job work is difficult, it is customary to rely almost entirely upon the experience of the electroplater through his observation of the "color" of the deposit, not only for the chromium coat but for the others as well.

Job shops have found that when chromium is deposited over a series of good preliminary coats of copper and nickel, immersion in the bath for from 4 to 5 min. with a current density of around one amp. p. sq. in. (144 amp./sq. ft.) with a temperature somewhat in excess of 100 deg. Fahr. will give satisfactory results. This experience in turn checks with experimental results indicating a certain critical range of temperatures and current densities, above and below which either blue or milky deposits will form. This range has been shown to lie within about 105 and 120 deg. Fahr. of temperature and from 60 to 200 amp./sq. ft. current density. Due to the lower cathode efficiency with chromium-plating, the current densities are higher than when plating other metals.

It is difficult to convince the average electroplater that a temperature change or variation of but two degrees will materially affect results, and it is essential that the effect of this and variations in current density be thoroughly understood. Many of the patents now covering chromium plating are associated with methods of controlling these two factors.

While the deposition of cadmium is not new, the use of this metal as a protective coating has only become popular commercially within the past few years. For a time there remained some question as to whether or not it could furnish as great a resistance to iron and steel as when zinc was used, but due to the fact that cadmium will not of itself corrode as rapidly as zinc, and methods for its application have been improved, it has been accepted as an excellent coating on parts where the softness of the metal is not objectionable or where rust resistance rather than a high finish is sufficient.

So far as can be determined, cadmium plating through the application of established commercial processes has in practically all cases been satisfactory, one of the few problems being to secure a smooth and unmarked coat over castings. This difficulty results from acid from the pickling bath remaining in the pores of the casting which comes to the surface when the cadmium plate is added. If after pickling (muriatic acid bath) and rinsing, the parts are dipped in a cyanide bath to remove any oxide and then again thoroughly rinsed, trouble from this source is largely eliminated.

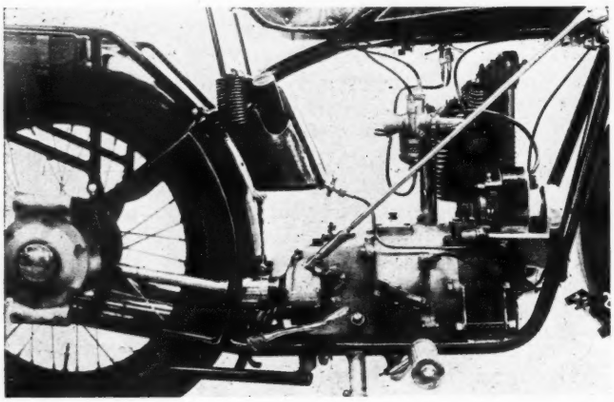
It is in the development of mechanically-operated plating cylinders that a great advance in cadmium and also nickel-plating has been made, for with them small parts need no longer be separately mounted on plating hooks or hangers, but are handled in bulk, the construction of the cylinders being such that electrical contact and current flow are taken care of automatically. Such products as nuts, lubricator fittings, ignition unit parts and similar pieces are readily handled by this process.

Along with cadmium-plating has come a renewed interest in mercury-zinc plating which for the past three years has been used for coating rims, bolts and nuts.

That development in the age-old art of plating has by no means reached a static condition may be noted by anyone closely following the changes being made in the many plants doing this class of work. Variations in the types of solutions used, more scientific methods of solution control, the application of production principles to continuous operation of plating processes, the recently announced accomplishment in the commercial electro-deposition of aluminum, the broader application of chromium-plating and many other factors all point to a future which will be of increasing interest and value.

Shaft-Driven Motorcycles Gaining in France

FOR the first time in the history of the French automotive industry motorcycles and bicycles have been given an independent exhibition in the Grand Palais, contrary to the usual practice which placed them in the galleries of the automobile show. The separate motorcycle show has been made possible by the exceptional growth of the movement in France during the past two or three years. Last year the number of motorcycle registrations in France increased by 100,000, and attained a total of 235,000; this increase is likely to continue at a greater rate during the next few years.



Close-up view of a new French motorcycle engine (Favor). Note shaft drive

The French industry is laying plans for increased business and appears likely in a very short time to capture the entire home market and secure a share of the export market. In the present show there are only two American makes, Cleveland and Harley-Davidson. British makes always have been stronger on the French market, but during the last few years they have lost ground.

Greatest demand is for machines of 350 cc., this size being considered sufficiently big for all practical purposes. The number of engines of 500 cc. is increasing, but it is still in a decided minority. Leading technical developments are engine, clutch and transmission in one unit, with final drive by a single chain. The two-stroke engine has lost ground to the four-stroke and there is an increased number of engines with overhead valves and inclosed overhead camshaft. There are several examples of two-stroke engines with a turbulence combustion chamber.

One German and five French machines are shown with engine across the frame, clutch and transmission in one unit and final drive by shaft and either bevel or worm gearing. Some other leading makers, among them being Alcyon, probably the biggest producer in France, are working on these lines and will have shaft-driven models next year.

Proper Sales Planning is Employment Factor

(Continued from page 687)

edged influence are likely to have only minor, even though distinctly helpful and favorable, effects.

Thus is added, from a different angle, another strong confirmation of the striking statement made on the first editorial page of this issue by Du Bois Young, a production man of many years practical experience both as a worker and an executive. Not all, to be sure, but many of the most vital automotive production problems existing in 1928 seem likely to lie in the hands of the sales department for their ultimate solution—and among the most important of these problems is that of labor stabilization.

Other Methods Also Helpful

Recognition of this outstanding fundamental in the problem of automotive labor stabilization need not minimize the strong remedial values of the many practical methods being used to gain the highest degree of stability possible under the economic conditions existing at any given time. The matter has been presented in this way merely to emphasize relative values as clearly as may be, because, as Arthur Pound so vividly stated in "The Iron Man in Industry":

"We moderns suffocate under an avalanche of facts; our distress is due, not to the facts, but to our difficulty in discovering their relationships and reducing them to comprehensible order."

The fact that Mr. Pound himself seems to us to have suffered from just this difficulty in drawing his conclusions in that famous book, does not alter the truth of the statement itself.

In fundamental as well as in detailed ways, the automotive industry has worked toward labor stabilization in recent years so effectively as to merit a high rank among those industries which have been giving serious attention to this basic social and economic problem. Automotive efforts have been generated for the most part by the vision of manufacturing and management gains to be made through better stabilized employment and for that reason bid fair to have quicker, more practical and more effective results than some of the more purely altruistic and spectacular but less dynamic endeavors along the same line.

In the first place automotive men generally are accepting the problem as one which must be met by each individual factory. Generally speaking they are not prone to pass the buck by urging that great national organization of public works, control of labor supply and so forth are the only means of making any progress.

A "Business Calamity"

Talks with many automotive executives as well as examination of their activities indicate a general agreement with the view expressed by Gordon S. Watkins in his new book "Labor Management," that: "Unemployment is now seen not only as a great social evil but also as a great business calamity; it now appears as a manifestation of inefficient industrial organization, an evidence of incompetent business administration, a proof of stupendous economic waste." Automotive men would seem to be working along the lines further indicated by Watkins when he points to the need of "devoting attention to the regularization of employment through improvement in the technique of management within the individual establishment and the individual industry," and of turning "the searchlight of investigation upon the relation of managerial efficiency to discontinuity of work . . ."

Numerous specific activities bear out the idea that automotive executives are tending to operate along these definite lines. To begin with, the last five years has seen more sensible, practical and yet scientific application of statistical and economic research to automotive marketing than ever before.

In practically every automotive center, employers have grouped themselves for cooperation along employment lines, the Employers Association of Detroit being an outstanding example of this kind of group. Through such cooperation activity, it is possible to keep track of actual employment conditions, to devise and execute means of stabilizing adverse situations as they arise, and generally promote greater stability of employment in the particular city.

Plant expansions, while still steady in the automotive field, are no longer undertaken with the abandon which once characterized many moves of this kind.

Then, too, with a few important exceptions, automotive production managers today have got into the habit of exercising all of the useful routine controls of fluctuation of their working forces as a matter of habit. It has become almost general practice to cut working hours long before actual laying off of men takes place. One typical company, for example, cuts time in half before starting to lay off men. Past that point, the time cutting process in this case is held to be uneconomic. When actual cutting of forces begins, the unskilled men are laid off first. Certain men never are laid off under any circumstances.

Definite planning of maintenance work has helped to keep the force more stable in a number of instances, while slack demand times in other cases often are taken up in production of parts for replacement stocks.

Safety Work on High Plane

Those layoffs which result from injury, accidents and sickness are held to a minimum in most automotive plants by very active and intelligent safety work and medical departments. Generally high wage standards and a decrease in the tendency to cut piece rates arbitrarily when a certain earning power has been reached have combined with the generally good working conditions in automotive plants to hold down that instability in the working force caused by strikes and labor troubles. It is worth remarking here, however, that the time lost in industry generally due to labor troubles is relatively insignificant, running probably between 1 and 2 per cent of the total number of working days lost by American wage earners.

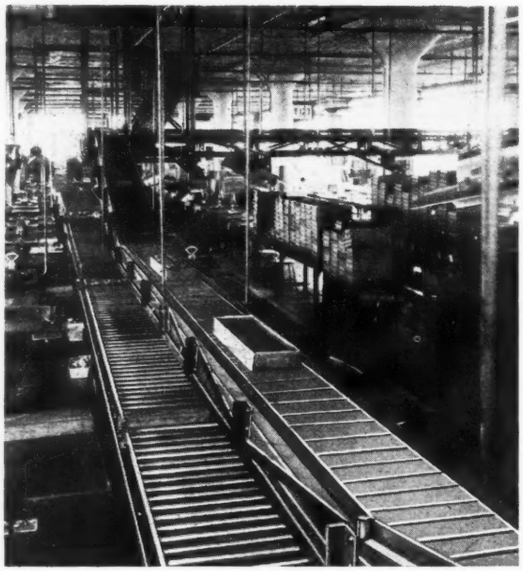
While seasonal fluctuation in automotive production still brings with it seasonal fluctuation in working forces, comparisons show clearly that the number of employees fluctuate far less widely than does the actual production. Then, too, the cyclical business influence remains a far stronger factor than the seasonal one in any case, as has been pointed out.

Thus it would appear that the automotive industry as a whole is working definitely along constructive lines so far as labor stabilization is concerned, and that the effectiveness of its efforts depends largely on the progress made by the practical economists among its manufacturing executives.

Material Handling Equipment

Has Outgrown Original Moving Material

By K. W.

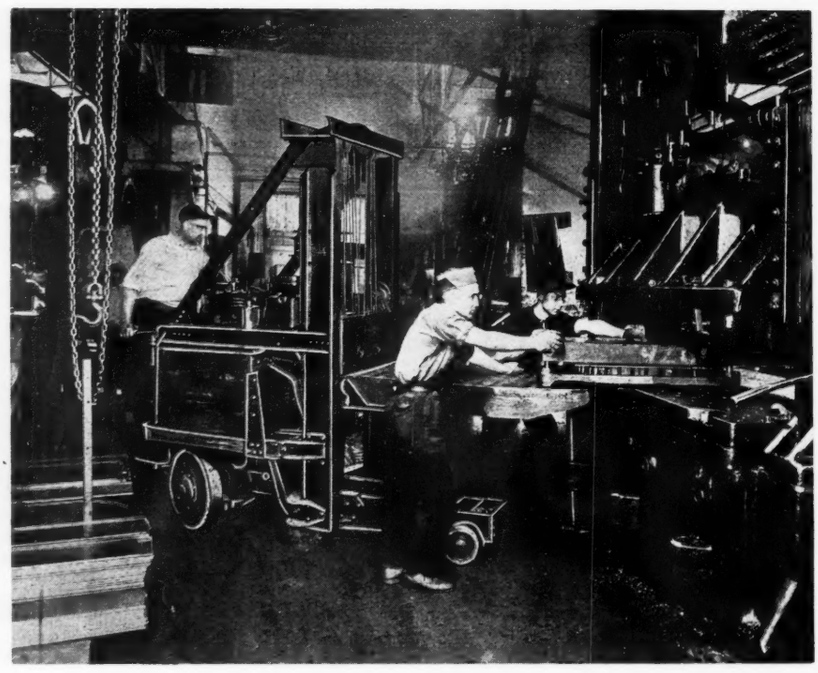


IN the speedometer department of the AC Spark Plug Co., where magnets are installed, the magnets, in trays, are brought to the assembly floor by means of Logan overhead apron conveyors and are delivered to stations along the gravity conveyor assembly line. Where the operators are stationed the apron conveyor drops to a convenient height and then rises to provide ample head room. The empty trays continue their travel on the same conveyor and are thus returned to the magnet department

MECHANICAL handling equipment has outgrown its original function of simply transporting material from place to place and has taken a new position as a very important part of actual productive operations. For many years, of course, in the conveyor assembly lines of automotive plants, mechanical equipment has played an important part in operations, but within recent years this function has been extended to all parts of the plant.

The battle cry of modern crusaders against production inefficiency is, paradoxically, "Use material handling equipment to eliminate handling of material," or, as some others express it, "Make moving a part of making."

Both of these ideals have been carried out to a remarkable extent in automotive plants, as the examples cited here will show. It is no longer considered sufficient in many plants to bring a



ANOTHER place where mechanical equipment has made large savings in handling costs is in the job of changing dies. A lift truck is frequently used, as shown in the accompanying illustration, and by means of it what might be a very difficult job becomes relatively easy. This is one of the many Baker-Raulang trucks being used for this purpose, this particular truck being used in a Fisher body plant

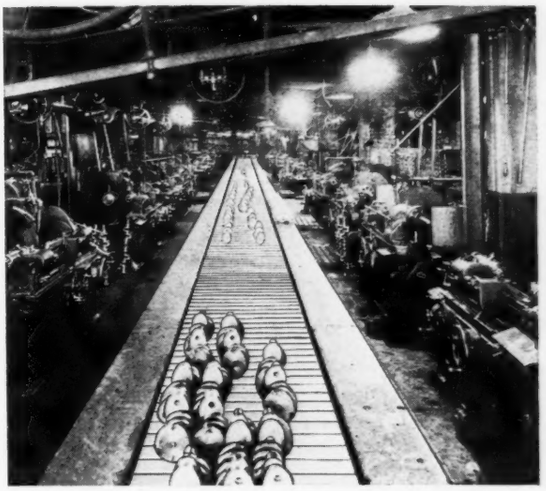
Harnessed for Productive Work

Function of Simply About Plant

Stillman

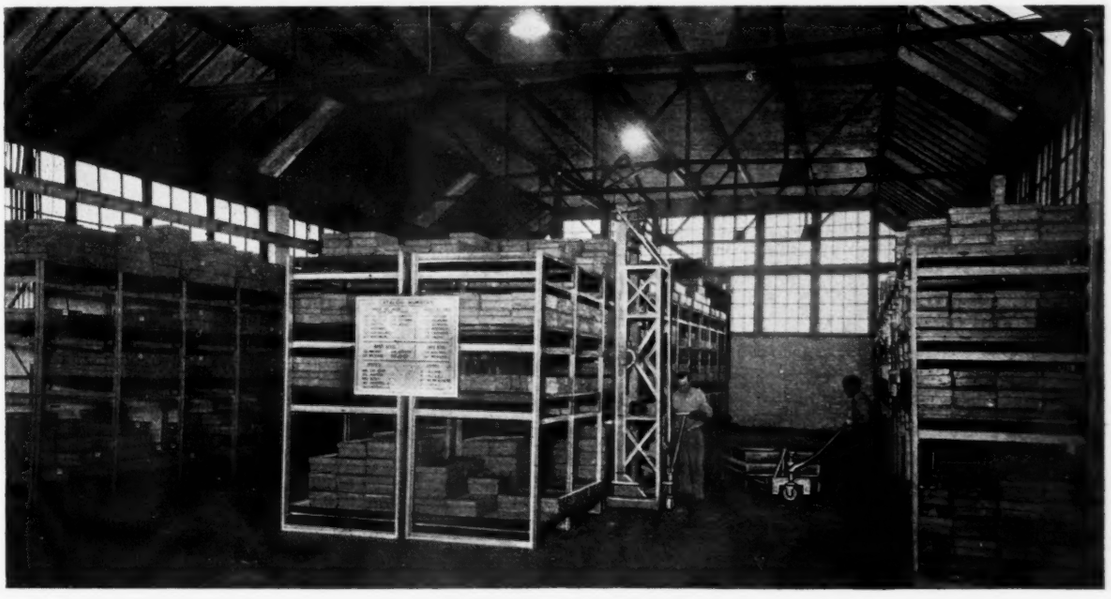
cylinder block, for instance, within reach of a hoist serving a drill press. Instead, the conveyor carries the block right under the press where it is located, drilled and pushed on to the next operation without any handling whatsoever by the drill press operator.

This, in effect, is the trend of present-day developments in material handling methods. Following are numerous examples, taken from many automotive plants showing how a wide variety of such jobs are being made easier and are being performed faster and with less human effort by making use of the potential labor-saving possibilities contained in all sorts of mechanical handling equipment. Many of the jobs described are of such nature that they can be adopted without change in many plants while other examples are capable of wide adoption with but very little change to adapt them to special circumstances.

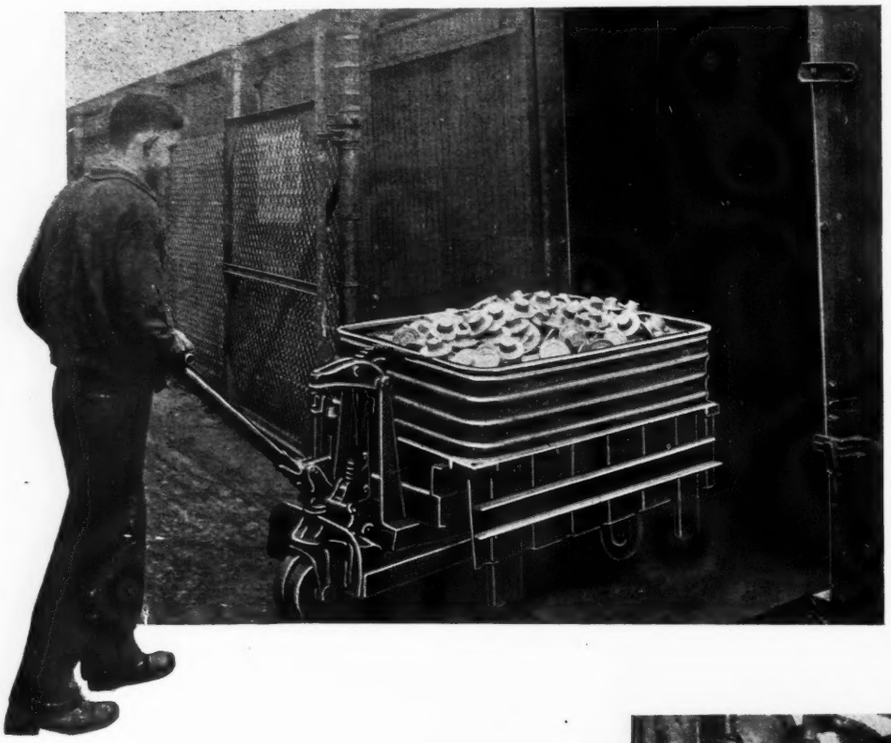


CHRYSLER crankshafts are carried from machining operations to the grinding room, where finishing operations are performed, on this Standard steel slat conveyor. From the grinders, the finished shafts are conveyed to the motor assembly department on the same conveyor

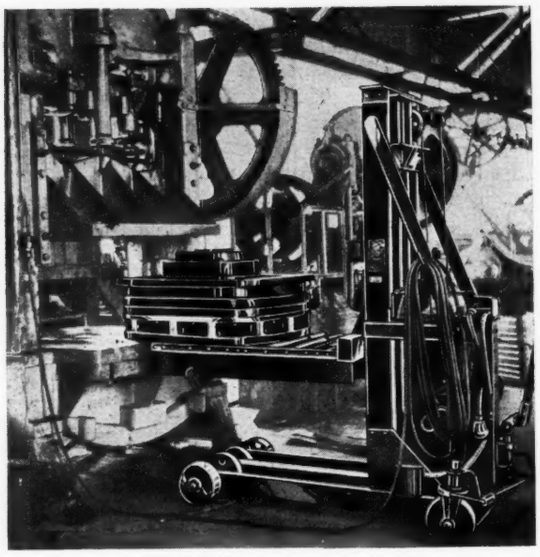
ANOTHER elimination of handling in the stockroom is illustrated below, where the jack-rack-stack system of handling small machined parts is employed. Parts are placed in tote boxes and placed on skid platforms. Both the stacker and the lift-truck handle the platforms and make all parts immediately available. Equipment used in this installation was furnished by Lewis-Shepard Co.



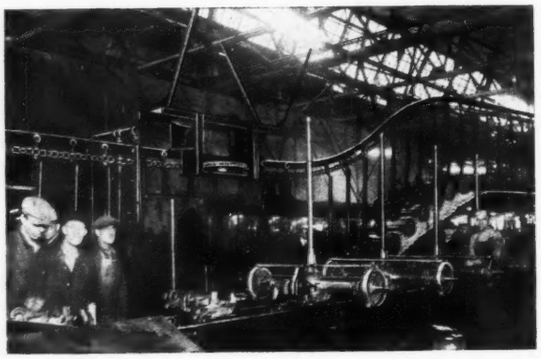
MATERIAL HANDLING METHODS



CONSIDERABLE interest has developed among shippers concerning shipments of small parts in containers on skid platforms to eliminate handling in unloading freight cars. Here is how one automotive manufacturer is using Lewis - Shepard lift trucks, skid platforms and containers to eliminate all handling from the time the material leaves the supplier's plant until it is placed in the production line



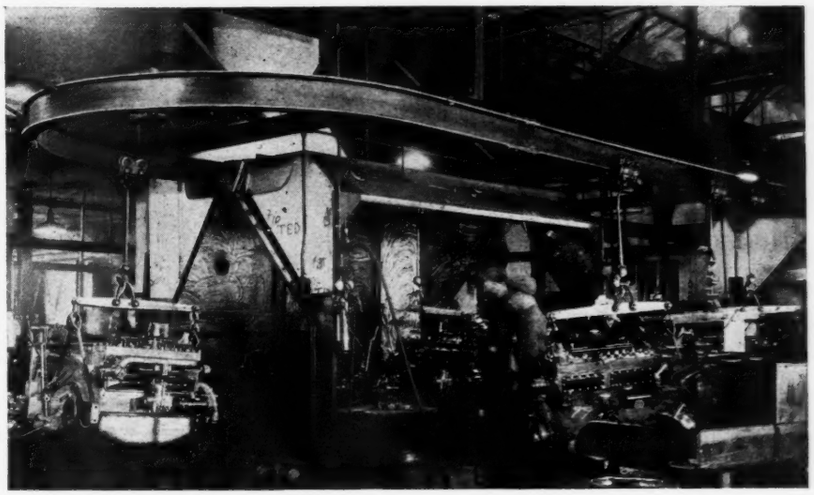
ANOTHER illustration of the use of lift trucks in handling heavy dies is shown in this Lewis-Shepard illustration in a large body plant. Only two men are required to move this heavy die from storage to the press

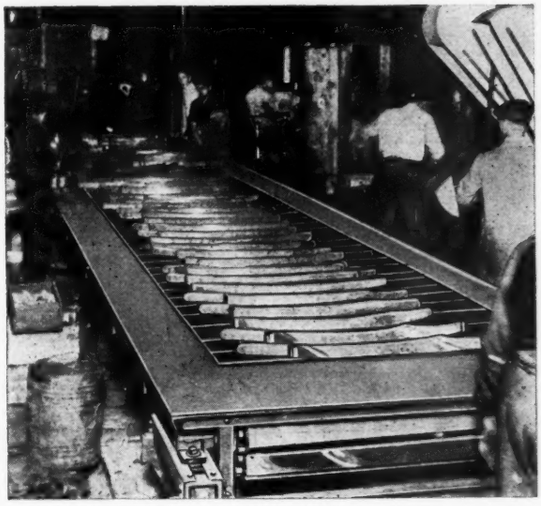


IN this installation of Mechanical Handling Systems equipment in a well-known plant, rear axles are carried through all their assembly operations and through the painting booth without leaving the conveyor. As can be seen in the illustration, part of the installation consists of an overhead monorail system from which the axles are suspended, while most of the assembly work and the painting is done while the axles are being carried on an apron type conveyor

MATERIAL HANDLING METHODS

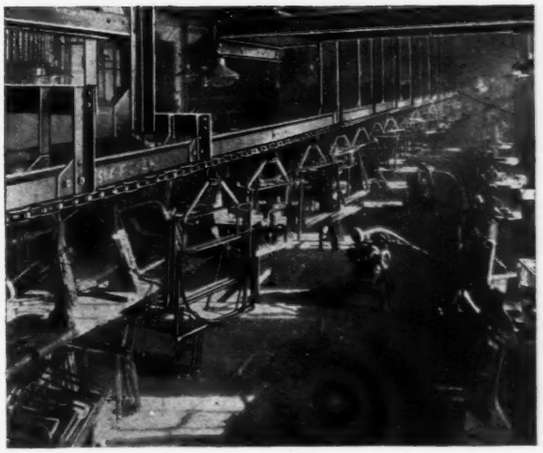
THIS is a typical automotive installation where various automotive parts are carried through paint spray booths on a monorail conveyor. Here engines are being spray-painted while they are being carried along on a conveyor line installed by Mechanical Handling Systems, Inc.



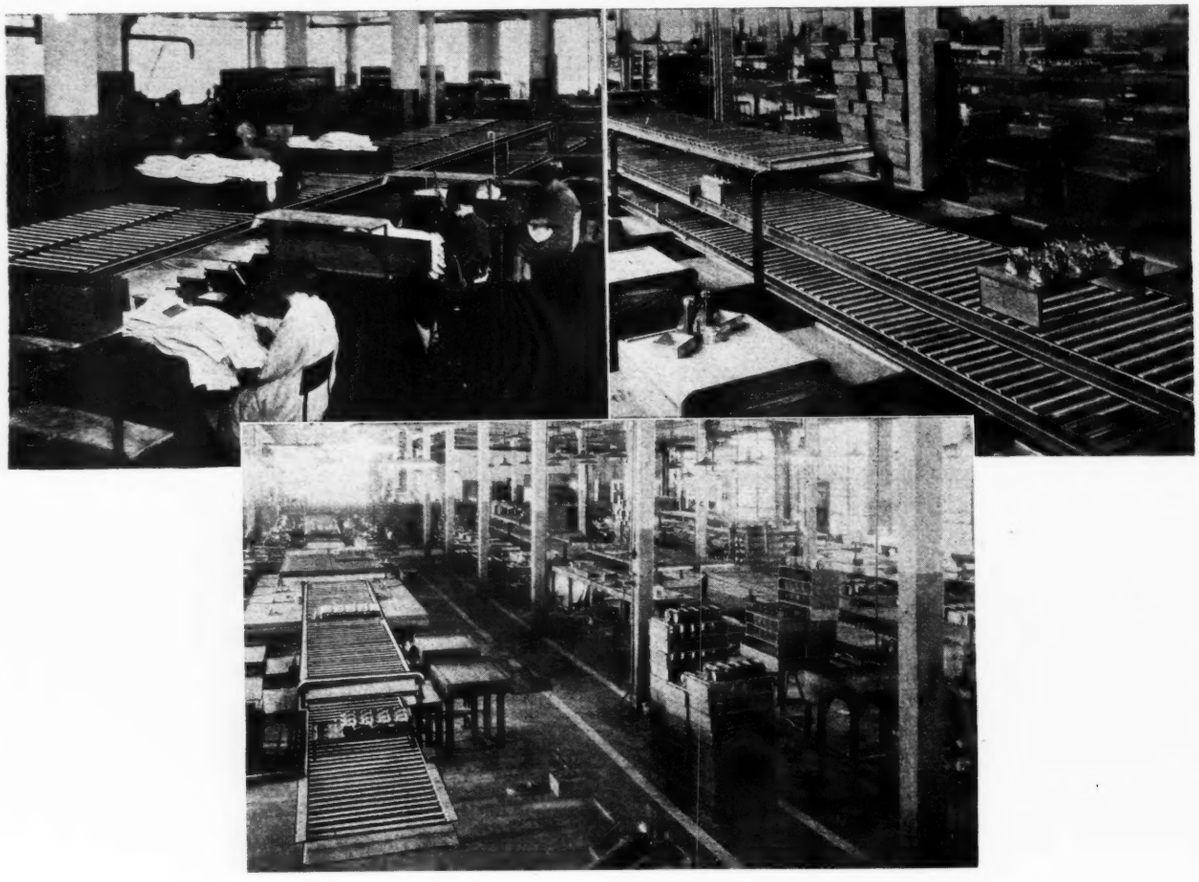


AT the Penn Spring Works, this Standard steel slat conveyor is used to convey springs past various production operations to provide a continuous supply of unfinished work for the operators

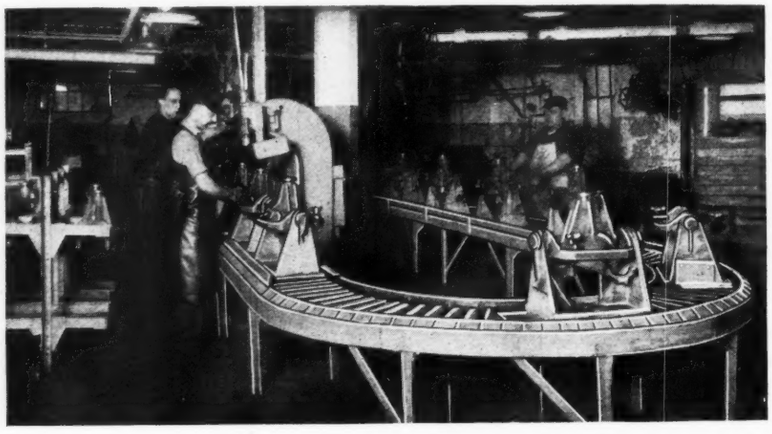
DOOR and window trimming for Studebaker cars is carried through the various operations of cleaning and polishing and then through lacquer spraying booths and baking ovens by means of a Logan overhead chain conveyor



MATERIAL HANDLING METHODS

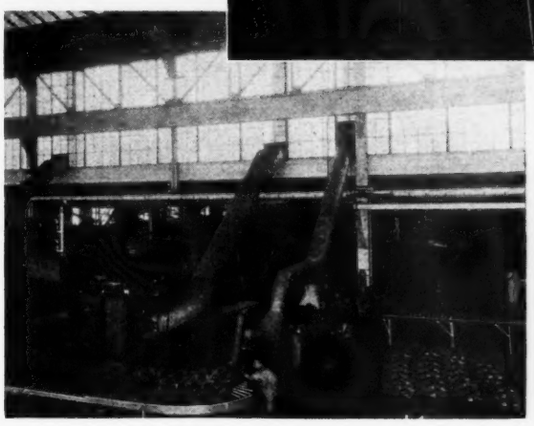


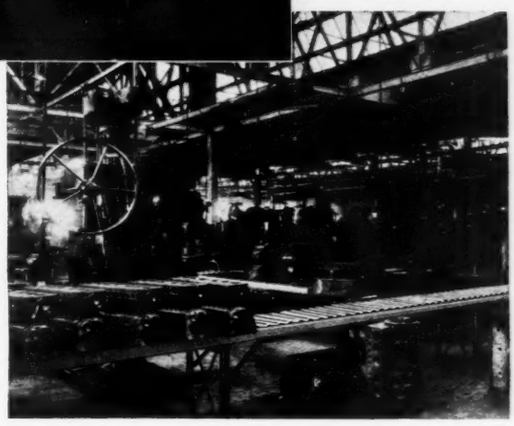
THE three illustrations herewith show how the AC Spark Plug Co. is utilizing conveyors to deliver work and remove it directly from operating stations. The right-hand top view shows gravity conveyors, in four tiers to keep the various operations separate, carrying racks of speedometers to and from assembly benches. The bottom illustration shows three lines of gravity conveyors of four tiers each, serving another section of the speedometer department. In the third picture gravity roller conveyors of three tiers are handling trays containing the filter cartridges for oil filters. Sewing operations are performed along this line and the three tiers separate the work in its various stages. All these conveyors illustrated were installed by the Logan Co.



IN the Willys-Overland plant, differentials for Whippet cars are assembled without removing them from a conveyor. The conveyor, a Logan roller type, carries the parts under the various tools which are required for assembly and the work is delivered from one job to the next without handling

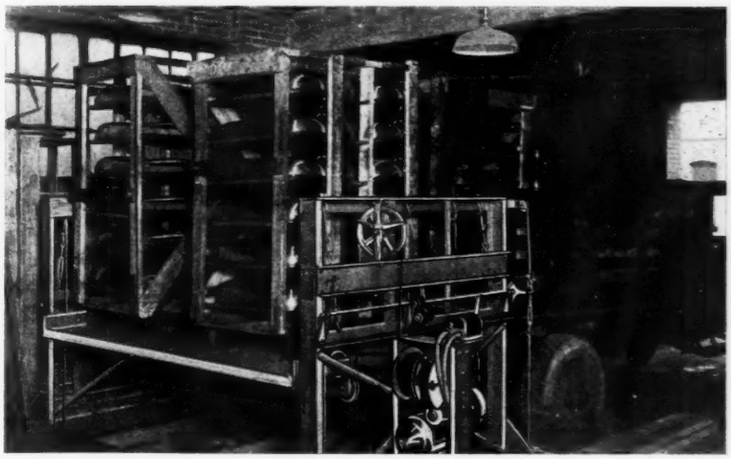
[MATERIAL HANDLING METHODS]



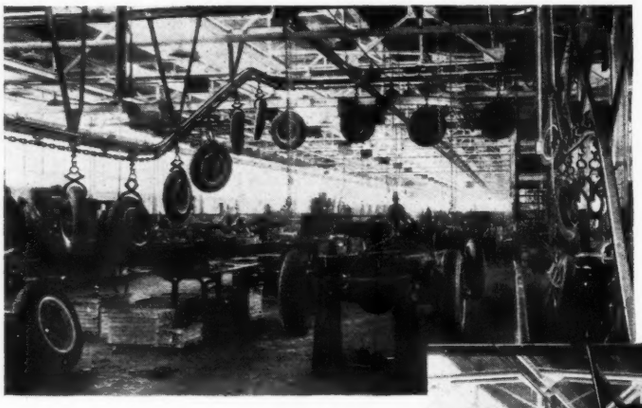


IN the Oakland plant, Pontiac engines spend nearly all of their time on conveyors when not being machined, and a considerable portion of the time they are being worked on is also spent on conveyors. In the lower left-hand illustration herewith is shown how they are passed through cleaning operations on conveyors and the other two pictures indicate the extent to which conveyors are being used to carry the blocks directly to and away from machine tools so that a minimum of manual handling is necessary in the machining processes. The conveyors shown have been installed by the Mathews Conveyor Co.

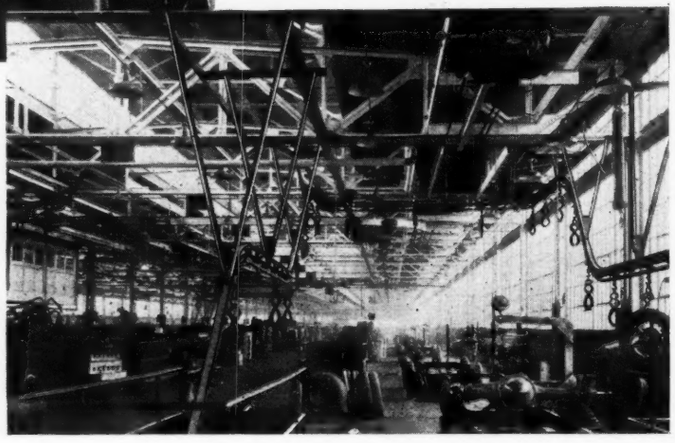
AN unusual application of mechanical equipment to eliminate unnecessary handling is seen in the installation of a Lewis-Shepard stacker for loading trucks without the use of ramps. This is particularly useful in plants which do not have loading docks at truck height



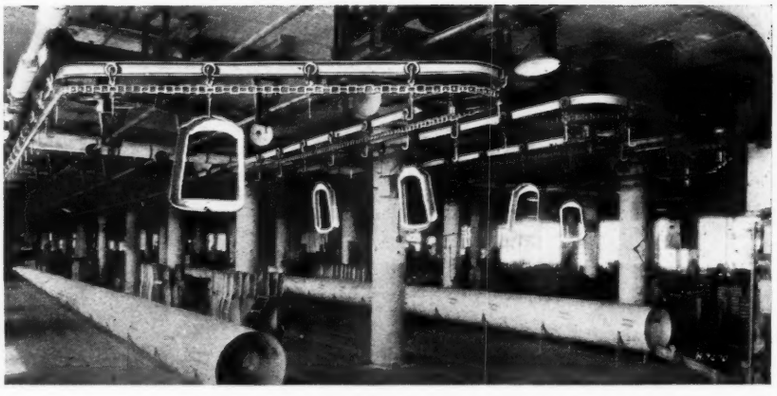
MATERIAL HANDLING METHODS



IN the Pontiac plant of the General Motors Truck Corp., mechanical handling equipment has been very fully utilized. The two illustrations show how both overhead conveyors and electric hoists play parts in the production processes



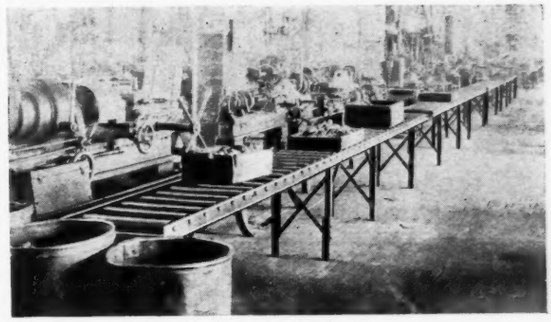
THE hoists in this installation are Lo-Heds made by the American Engineering Co. and are used to turn the partially assembled chassis, to raise trucks from one floor to another, etc., while the particular conveyor illustrated is for conveying wheels to the assembly points



SOME idea of the intricate installations of mechanical handling equipment made possible by the use of overhead mono-rails may be obtained from this view of a department to be used for plating and buffing radiators. When the picture was taken the buffing wheels, which occupy the foreground, had not been installed, but the mono-rail conveyors bring the plated pieces directly to the wheels. This is a Mechanical Handling Systems installation

MATERIAL HANDLING METHODS

AT the Chrysler plant boxes containing machined parts are carried on Standard gravity rollers from one end of the machine shop to the other and provide a supply of unfinished parts to machine operators and a place to put their finished work



AT the Studebaker plant, Logan belt conveyors are employed to facilitate progressive machining of small parts. A small chute leading from each machine deposits parts on the belt from which they are automatically deflected into a storage bin serving the next machine. These operations continue on down the line until the part is completed with an absolute minimum of handling of the parts

THE use of a magnet truck eliminates a great deal of handling when moving small pieces. This Baker-Raulang truck is used at the Oakland plant for unloading small casting from box cars. With it one man unloads a car in 40 min., a job which formerly required the service of four men for three hours

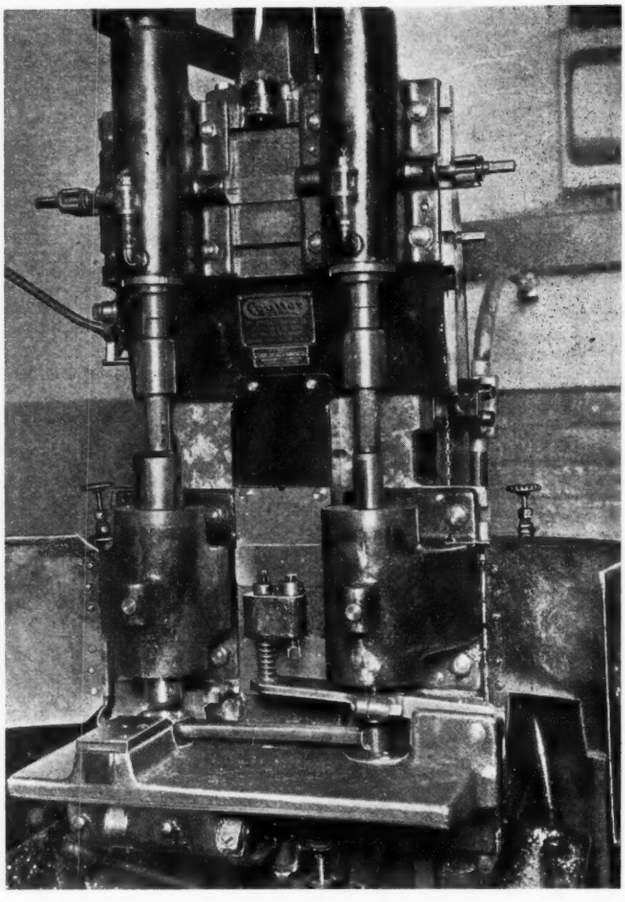
Diamond Boring Operations

Fairly high output now obtained, especially when use is made of machines which bore two holes at once. Practice still confined largely to connecting rod work.

By A. F. Denham

DURING the past few years the possibilities of diamond boring have intrigued the automotive manufacturing industry, what with the ever-growing desire for higher precision finish of parts such as bearings, etc., on which to a very large extent depend the life of the motor car. It is the purpose of this article to show to some length the advances which have been made in this art. While it has not been attempted to make a complete survey of the industry in this respect, a sufficiently large number of plants have been covered to form a rather general picture.

While diamond boring at present is being used experimentally and also to a limited extent in production on other parts, its major application is found in connecting rod bushing and lower end bearing machining. This development has come with the demand for higher precision not only as to finish of the surface itself, but also as to out-of-round and taper of the holes, neither of which are as susceptible to control with other methods of finishing as with diamond boring. Closer adherence to correct tolerance limits further assures a more standardized assembly and eliminates to some extent the necessity of close assembly checking of sizes. This is especially true of connecting rods which are assembled without shims. In these, tapered or out-of-round holes would mean, after the wearing-in period, loose rods or piston pins as the case may be, and in addition there is the danger of



This machine is used by Packard for the simultaneous diamond boring of crankpin and piston pin bushing holes of connecting rods. Note the spring tension automatic clamp used

TABLE 1

Company	Machine	Part	Material	Speed	Feed	Depth of Cut	Tolerance	Diamond	Production
Packard	Coulter	Conn. rod	Babbitt	1600	0.0024	0.012	0.0005	Bortz	80 pr. hr.
			Bronze	3200	0.0012	0.010	0.0001	Carbon	
Cadillac	#	Conn. rod	Babbitt	1750	0.0015	0.010	0.0005	Bortz	45 per hr.
			Bronze	3000	0.00075	0.005	0.00025	Bortz	
Graham-Paige	Coulter	Conn. rod	Babbitt	2000	0.002	0.007	±0.0003	Bortz	170 per. hr.*
Hupmobile	Coulter	Conn. rod	Babbitt	1750	0.003	0.015	0.0003	Bortz	85 pr. hr.
			Bronze	3500	0.0015	0.0075	0.0001	Bortz	
Oakland **	Coulter	Conn. rod	Babbitt	2000	0.001	0.014	0.0002	Bortz	No data **
			Bronze	4000	0.00025	0.006	0.0002	Bortz	
Oldsmobile **	##	Conn. rod	Babbitt	1800	0.00125	0.012	0.0004	Bortz	No data **
			Bronze	2700	0.00075	0.010	0.0004	Bortz	
Wilson Foundry	Own	Conn. rod	Babbitt	1750	0.0015	0.012	0.0003	Bortz	60 pr. hr.
			Bronze	3500	0.0007	0.010	0.0003	Bortz	
Packard	Hendy lathe	Camshaft bearing	Cast iron	1600	0.0012	0.010	0.0005	Carbon	Experimental
Cadillac	Special lathe	Crankcase	Aluminum	1800	0.0015	0.015	0.0005	Bortz	Experimental

* Two-spindle, two rods at a time.

** Figures not final. Machines just installed.

Horizontal two-spindle special rebuilt internal grinder.

Vertical two-spindle commercial diamond boring automatic.

Placed *on* Production Basis

Another method of handling the two-spindle automatic when only the babbitt end is diamond bored is shown here. This adaptation was made by Graham-Paige. The piston pin end is located by a fixed plunger and the large end is automatically clamped

seizing or burning during the period of running in.

As to the machine tools used for diamond boring of connecting rods, numerous attempts have been made, especially in the early days when special machine tools were not available, to redesign existing machine tools. In a few cases these have proved quite successful. In others trouble was encountered in attempting to hold machine operations to close limits and such machine tools have been replaced by special equipment designed specifically for diamond boring.

Analyzing diamond boring operations in general, as per the attached table, it will be noted that quite satisfactory production rates are being obtained, especially with those machines on which two holes are being bored at once. On the other hand, Table 2 shows very definitely that maximum production speeds, as limited by the ability of diamonds to cut, have not as yet been reached. It will be noted that peripheral cutting speeds for both babbitt and bronze ends increase with an increase in diameter of the bearings, thus indicating that the limiting factor for cutting speed in revolutions per minute is in the machine rather than in the cutting tool.

TABLE 2

Diameter (In.)	Cutting Speed (Ft./Min.)	Metal Removed (Cu. In./Min.)
	Bronze	
.797	650*	.056*
.875	710*	.068*
1.000	920	.113
1.060	1110	.200
	Babbitt	
1.875	880	.159
2.000	20	.198
2.125	975	.526
2.188	920	.317
2.250	1175	.198
2.375	1080	.196
2.375	1250	.209

(*Average of two.)

In analyzing amount of metal removed in cu. in. per min. the table on bronze bushings further shows the truth of this statement. The same picture is given more or less in the babbitt end table, although here two high cuts are found in the middle of the table. Since the machine tool is the limiting factor in cutting speeds, such a situation is to be expected and bears out the contention of factory tool superintendents that depth of cut in diamond boring is not important in determining speeds in r.p.m. By referring to Table 1, it will be noted that the depth of cut for the babbitt end ranges from 0.007 in. to 0.015 in. On the bronze end the variations in depth of cut are from 0.005 in. to 0.010 in.

There also seems to be no definite figure for correct amount of feed, this varying on the bronze end from 0.00025 in. to 0.0015 in. and on the babbitt from 0.0010 to 0.0030 in. Feeds are generally worked out by the individual company to obtain the maximum production possible within the set tolerance limits and desired finish.

Little Known as to Diamond Life

As to diamond life even less is known. Diamonds have been found to cut as many as 60,000 to 70,000 holes. Others have to be relapped after only a few cuts. The two chief difficulties seem to be first, the obtaining of good grade industrial diamonds with no porosity, and second, proper lapping, the latter being a highly specialized art at present. In the factories covered, only one maintains its own diamond lapping operator. Average commercial cost of relapping diamonds seems to be in the neighborhood of $7.

Breakage of diamonds seems to be due in most cases entirely to carelessness of the operator. It is also stated that considerably more breakage of diamonds occurs in most plants on the night than on the day

shifts. From the meager information available it would seem that a diamond which cuts around 5000 to 10,000 holes without relapping can be considered a pretty fair stone.

Diamond boring of cast iron and aluminum has not become widespread at present, especially on cast iron, several plants which have attempted it experimentally having given it up, claiming that it requires too rigid a silicon control in the foundry. Packard, however, seems to be having considerable success with a diamond boring operation on the rear camshaft bearing.

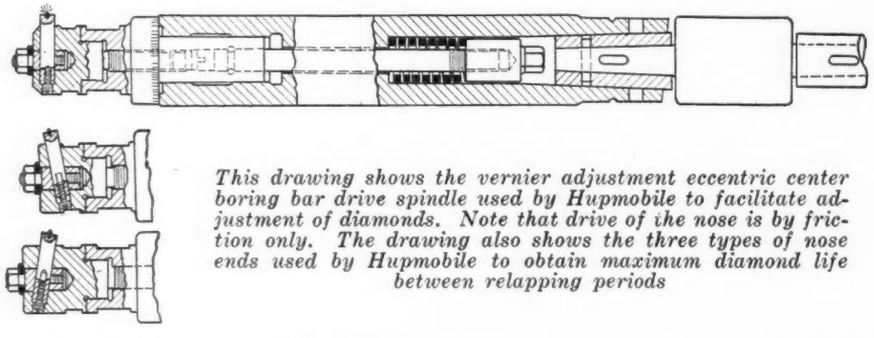
It is also understood that diamond boring is being developed for the pin holes in the piston. This would be a logical development, since often the accurate machining of connecting rod upper bearings is offset by inaccurate finishing of the corresponding holes in the piston, throwing the piston out of line and requiring the straightening of connecting rods after assembly with the piston.

Diamond boring for finishing larger parts, such as cylinder bores and sleeve valves, etc., would seem to depend largely on the development of special machinery capable of performing these operations with a minimum of flexing of the cutting spindle, accurate locating of the part being machined and overall rigidity during the cutting operation.

Following is a summary of diamond boring operations being conducted in a number of automotive plants, with additional comments on the subject:

The Cadillac Motor Car Co. is one of the few companies which is using for diamond boring of connecting rods machine tools of their own development. For this purpose a number of internal grinders were rebuilt and in them were incorporated commercial internal grinder spindles to drive the boring bars through universal joints. A feature of the tool is that the work is held stationary and is located between the driving and working heads, the boring bars feeding toward the driving head rather than away from it. It was found that in this type of tool, as in all others used for diamond boring, one primary essential was the maintenance of minimum clearance for the bearings carrying the boring bar. To do this the bearings of this tool are burned in, the process requiring about five hours for each set of bearings. Gravity lubrication using a very thin oil is then used for the bearings. The success of this method is evident from the close tolerances to which the bored holes are held, 0.00025 for the bronze and 0.0005 for the babbitt end.

Spindle speeds are 1750 and 3500 r.p.m. for babbitt and bronze ends with feeds of 0.0015 in. and 0.00075 in. respectively. Depth of cut left from the preliminary roughing operation is 0.010 for the babbitt and 0.005 for the bronze end. The most important requisite found for this operation was the proper mounting of rods to obtain good centering. To do this with the fixture used, faces must be accurate to 0.001 in. The rod is located in the machine by means of locating bars. The large end is held between the faces and the small end is clamped from the top against a spring plunger having an equalizer leaf, the rod shank below the pin end resting on this plunger which is locked in place before clamping the pin end. The top clamp point is directly over this equalizer. The locating bars are in the opposite side of the head from the boring bars. Production rate is between 40 and 50 rods per hour per machine.



This drawing shows the vernier adjustment eccentric center boring bar drive spindle used by Hupmobile to facilitate adjustment of diamonds. Note that drive of the nose is by friction only. The drawing also shows the three types of nose ends used by Hupmobile to obtain maximum diamond life between relapping periods

5000 Holes Without Redressing

It is found that the average diamond produces about 5000 holes without redressing. Setting of diamonds is accomplished on the tool itself by means of a special fixture equipped with micrometer dial gages mounted on the machine. Master bars are used for checking the gages.

Another item of interest is that the direction of pressure feed of the cutting fluid is against the direction of travel of the boring bar and at an angle, so that maximum agitation is produced when the cutting fluid impacts against the rapidly rotating boring bar working against the inside surface of the bearing being bored.

Cadillac is also using diamonds for the finish-boring of the main bearing holes and the camshaft bearing holes in the crankcase in order to obtain low variation in the size which assures maximum interchangeability as well as parallelism of these two vital sets of holes. This operation is performed on a special redesigned lathe. Boring bars are fitted with three diamonds each, one for each bearing. Spindle speed is 1800 r.p.m. using 0.0015 in. feed to remove 0.0015 in. depth of cut. Bortz diamonds are used for all operations.

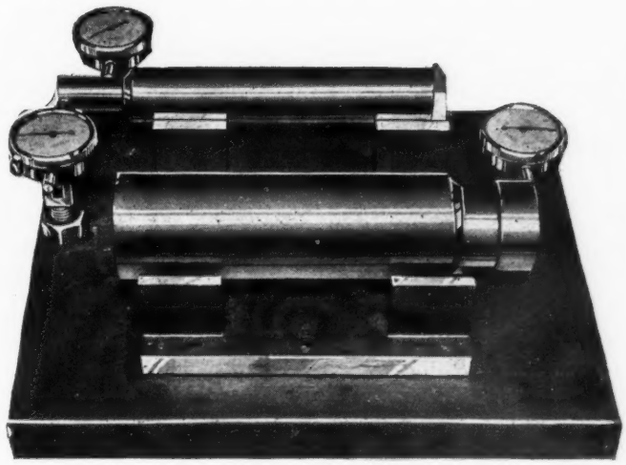
The babbitt ends of two connecting rods are diamond bored at one time on Coulter Automatic two-spindle machines at Graham-Paige. These spindles are driven at 2000 r.p.m. with a feed of 0.002 in., rods being held to plus or minus 0.0003 in. for out of round and taper. Rods are clamped automatically between the flat faces. Production is 170 rods per hour per machine or 1550 rods in a 9 hr. day.

Experience has shown at Graham-Paige that the "average" life of a diamond without redressing should be not less than 5000 holes bored. Bortz diamonds are used.

Unfinished Hole is Ground

In order to insure holding the rods to close limits for parallelism of bores, the unfinished piston pin hole is ground after diamond boring, locating from the diamond-bored hole by the use of an expansion plug, and no straightening is necessary. In this rod the pin is locked in the rod end and floats in the piston.

Connecting rods are diamond bored at Hupmobile on Coulter Automatics, both ends being finished simultaneously. The Hupmobile machines incorporate two special features for the accurate adjustment of diamonds, however. The first consists of an eccentric mounting for the boring bar within the driving spin-



Another method of setting the diamonds by calibration against a master bar resting in V-blocks is shown here. This method is used by Packard

dle, the boring bar being 0.00175 in. off center in the spindle for the babbitt end and 0.001 in. off center for the spindle used to diamond bore the bronze bushing. As will be noted from the attached sketch, drive is transmitted to the boring bar through friction only, there being no locking device for the bar after adjustment. Such a locking device has been found to be unnecessary and in fact undesirable. The necessary friction is obtained by means of the helical spring shown inside the driving spindle.

A chart is furnished the operator by means of which he can adjust the boring bar accurately after setting his diamond as near as possible with a micrometer dial gage. This chart shows the amount of diametral change for each numbered division shown on the boring bar. Adjustment to 0.00005 in. is possible by this means.

Close Tolerances Obtained

While maximum tolerances allowable are set at plus 0.0003 in., much closer adherence to required size can be obtained. In fact, rods in production check at an average of 0.0001 in. for out of round and taper as long as the bearings on the driving spindles are in good condition. Hupmobile also checks for parallel with the piston assembled, a tolerance of 0.001 in. being allowed.

The second feature in the diamond setting system is the provision of different types of nose ends, screwing into the boring bar, in which the diamonds are set either straight or at plus or minus angles of 10 deg. This permits turning the diamond to one side or the other when the spherical head is dulled at one point and increases the length of life for diamonds between relapping periods.

To date a maximum cut of 70,000 rods has been obtained without relap. Average cutting life is found to be around 10,000 holes per diamond without relap. Bortz diamonds are used. Diamond cost was found to be about 0.2 cents per rod during September, the last month for which data was available at the time of preparation of this article.

Speeds 1750 and 3500 R.P.M.

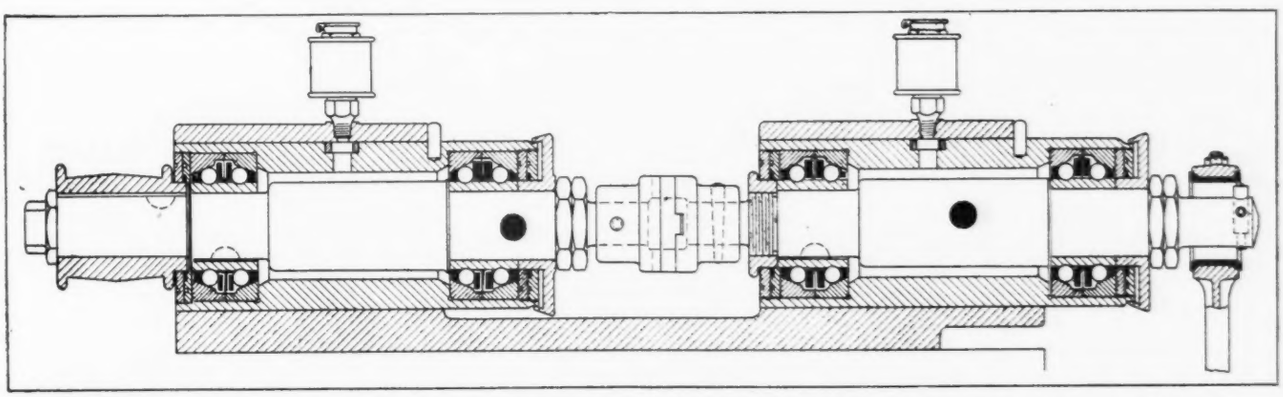
Speeds of 1750 and 3500 r.p.m. are used for big and small end spindles by Hupmobile, with feeds of 0.003 and 0.0015 in. respectively. Preliminary roughing operations leave about 0.0075 in. stock in the bronze and 0.015 in. stock in the babbitt end of the rod for diamond boring.

Production rate is about 85 rods per hour per machine.

Two Coulter Automatics have recently been installed by Oakland for the simultaneous diamond boring of both babbitt and bronze ends of connecting rods. While these have not been in service long enough to obtain any definite figures regarding such points as diamond life or production capacity, results so far have been very satisfactory. Tolerances are being held at present to 0.0002 on both ends for out of round and taper, and the rods themselves are held to 0.001 in. for parallelism of piston pin and crankpin holes.

Since rods are clamped automatically at the flat faces, the latter are held to 0.002 in. in the finish machining process and the same tolerance is set for the reaming operation preceding the diamond boring. At present the small end spindle is run at 4000 r.p.m. with a 0.00025 in. feed, while the crankpin end spindle is given a feed of 0.001 in. and is run at 2000 r.p.m. Depth of cut is 0.014 for the babbitt and 0.005-0.007 for the bronze end. Bortz diamonds are used for both ends for maximum length of life.

During the developmental diamond boring work, Oakland redesigned a number of short bed lathes and used these for finishing connecting rod bores. One of the difficulties encountered was that of holding the bores to less than 0.0003 in. for taper. Chrome plating the boring bars to decrease the bearing clearance did not help materially and the results seemed to indicate a fundamental requisite of diamond bor-



This drawing shows a section of the Excello diamond boring spindle used by several automobile manufacturers. Its ball bearings have practically no clearance, being lapped in under pressure from a negative clearance before assembly. Ball retainers are of bakelite

ing—that of holding the work stationary and feeding the spindle to the work. This the Coulter Automatics provide. The lathes operated fairly satisfactorily with tolerances of 0.0003 to 0.0004 in., but on setting closer tolerance requirements for this operation rejections increased to 15 per cent.

An interesting gage is used for 100 per cent checking of rods for taper at Oakland. It consists of a plug gage provided with spring operating balls in the side, the springs in turn operating a micrometer dial gage graduated in ten-thousandths.

New Machines for Oldsmobile

Two spindle vertical automatics are being placed in the production line at Oldsmobile at present for the diamond boring of connecting rods, both ends being bored simultaneously. These machines incorporate a special feature designed by Oldsmobile. Instead of locating from the flats of the rods, three centers are drilled on the rod sides, two at the babbitt end and one at the pin end following the babbitting operation, and these centers are used thereafter for all finish machining operations. It was found that the spring tension clamp of the machine tools used for diamond boring did not have sufficient tension to hold the rods located in this manner, and an air cylinder was built into the machines.

Machines are set to run at 2700 r.p.m. for the bronze and 1800 r.p.m. for the babbitt end, with feeds of 0.00075 and 0.00125 in. respectively. Depth of cut is about 0.010 in. for the bronze and 0.012 in. for the babbitt end. Maximum tolerances of 0.0004 in. for both ends for out of round and taper are called for, and the rods are being held well within this figure. Checking for parallel is not performed until after the piston is assembled to the rod, and is then checked, using the skirt as a guide, with two micrometer dial gages, one for the head and one for the skirt. If holes are found to be out of parallel both piston and rods are then checked to trace the trouble. By this means one inspection operation is saved.

Production figures are not available as yet since the machines have just been transferred from the tool room production line to the actual machine shop. In this connection it is interesting to note that when new tools are installed in the production line they first go to the tool room and mechanics are taken from the production shop to work on the machine in the tool room. These mechanics then return to the shop with the machine tool, thus eliminating the necessity of training production men to handle the operation after transfer to the machine shop.

Packard Connecting Rods

Both ends of connecting rods at Packard are diamond bored simultaneously on Coulter Automatics. While tolerances can be held very much closer with this type of machining and a better finish can be obtained, another main reason for adopting this method, according to Packard production executives, is the reduction in machining time possible. Two of these machines are in use.

Rods are clamped automatically in this machine, locating from the semi-finished bores and clamping onto the flat face of the rod. While the roughing cuts, before diamond boring, reduce the depth of stock to be removed from bronze and babbitt ends to 0.010 and 0.012 in. respectively, it is stated that this is merely for more accurate locating and that the amount of stock left plays no function in determining feeds and speeds. The latter are governed mainly by the finish obtainable. These speeds for the Packard rods have been determined as best at 1600 and 3200 r.p.m. for babbitt and bronze ends respectively, with a feed of 0.0012 for the bronze and twice that for the babbitt end. Tolerances are held to 0.0001 for the bronze bushing and 0.0005 for the babbitt end.

Of the various troubles encountered in the development of efficient diamond boring at Packard, one of the major points was that of getting sufficient cutting fluid flow to wash chips away from the diamond point. At one time during the early development of this process cutting fluid was fed in the direction of the tool feed and chips would lodge under the diamond tip and cut "ringers" in the bearings. By reversing and increasing the flow this trouble was overcome.

An early problem also was the development of chatter marks in the bearings. It was found that if the diamonds were mounted in separate blocks with a slip-fit in the boring bars, this trouble was quickly overcome. One of the most important points in connection with diamond boring of course is the proper adjustment of the diamonds in the boring bars. This is done at Packard by mounting a master bar in a V-block and taking a reading from the micrometer dial gages attached to this special fixture. The bar carrying the diamond is then inserted and the diamond is adjusted to give the same reading as that obtained from the master bar.

Breakage Due to Carelessness

Regarding diamond life, no definite figures have been obtainable to date. It would seem that this depends almost entirely on the diamond itself and partly on the lapping. A maximum production of 62,000 holes with one diamond without redressing has been obtained so far, but the average figure would be considerably below this. Diamond breakage on the other hand in nearly every case has been traceable to carelessness of the individual operator. Both Carbon diamonds and Bortz are used at Packard, the latter for the babbitt end, being less brittle and softer, and the former for the bronze end.

Some experimental work is also being done at Packard on diamond boring cast iron. The rear camshaft bearing, which is a separate unit with a blind aperture, is now being diamond bored on a redesigned Hendy lathe with special heads and fixtures. These bearings are held to 0.0005 in. limit, with a cut of 0.010 in., a feed of 0.0012 in. and a speed of 1600 r.p.m. No special difficulties are being encountered at present. Silicon content does not seem to materially influence the effectiveness of the process.

Both ends of Willys-Knight connecting rods are diamond bored simultaneously by the Wilson Foundry and Machine Co. on special built machine tools mounted on lathe beds and incorporating Excello spindles.

In the preliminary operations large end faces are finished and the babbitt is reamed out to 0.012. This is done before finishing the rod pin hole in order to use the faces for locating for the latter operation. By this means, since the faces are later used for diamond boring, there is good parallelism between the bronze bushings and babbitt end bores before diamond boring, giving an even depth of cut and reducing or eliminating the amount of straightening necessary. Bushings as pressed into the rod require a stock removal of 0.010-0.012 in. during the diamond boring operation.

The method of mounting the rod in the diamond boring tool is as follows: The large end is located

first by means of a lever-operated plug in the head of the machine. It is then clamped in place, using the faces of the rods. For this purpose one of the clamping plates is of the universally mounted equalizer type, the other being fixed in the machine tool proper. The pin end is also located first by a sliding plug of the 2-point high-spot type, and the clamping of this end of the rod is effected on the shank of the rod below the pin hole, an equalizing clamp of the floating type being used, with the equalizer below. The floating clamp itself is locked after clamping this end.

Cutting fluid is pumped through the locating plugs in the head. Diamond boring bars are fed through against the flow of cutting fluid, these bars being beveled at the tips to deflect the cutting fluid and direct it against the diamond to wash away the chips.

In the Willys-Knight rods there are three separate intersecting oil grooves and to overcome any tendency of the diamond to jump and break when hitting these grooves and thus leave a high or low spot at these points, a flexible spring drive with no backlash is used in the drive of the boring bar for this end.

Production rate runs around 84 sets of rods per nine-hr. day per machine, which is in the neighborhood of 55 to 60 rods per hr. per machine. Spindle speeds are 3500 and 1750 for bronze and babbitt ends respectively, with feeds of 0.0007 and 0.0015 in. Maximum allowable tolerance is 0.0003 in. diameter and 0.0001 for both out of round and taper for both ends. Bortz diamonds are used for both ends.

Tests on Roots Blower-Type Superchargers

TESTS have been made by the National Advisory Committee for Aeronautics on three sizes of Roots type aircraft engine superchargers. The impeller contours and diameters of these machines were the same, but the lengths were 11, 8¼ and 4 in., giving displacements of 0.509, 0.382 and 0.185 cu. ft. per impeller revolution. The information obtained serves as a basis for the examination of the individual effects of impeller speed and displacement on performance and of the comparative performance when speed and displacement are altered simultaneously to meet definite service requirements.

According to simple theory, when assuming no losses, the air weight handled and the power required for a given pressure difference are directly proportional to the speed and the displacement. These simple relations are altered considerably by the losses.

In estimating the effect of speed on performance it is of interest to note that:

1. The difference between the actual power and the theoretical power was found to vary with the speed raised to the 2.5 power. The theoretical power was obtained by multiplying the pressure difference by the displacement and speed and dividing by the horsepower constant.

2. The volumetric efficiency of the actual machine remains nearly constant over a large part of the interesting speed range, the decrease in volumetric efficiency at a speed of 6000 r.p.m. being less than 2 per cent.

3. The ratio of the discharge air temperature to the inlet temperature was found to depend on speed. This effect of speed is represented by the coefficient "*C*" in the relation

$$\frac{T_2}{T_1} = C\left(\frac{P_2}{P_1}\right)^{\frac{n-1}{n}},$$

which has a value of 1 at zero r.p.m. increasing to 1.04 at 6500 r.p.m.

With regard to the effect of displacement on performance, the following points are of interest:

1. The power loss was found to increase with displacement.

2. The maximum volumetric efficiency increased somewhat with increase in displacement.

3. The relation between the inlet and discharge temperatures and pressures as represented by the exponent "*n*" in the above equation was found to increase from 1.36 to 1.53 with increase in impeller length from 4 to 11 in.

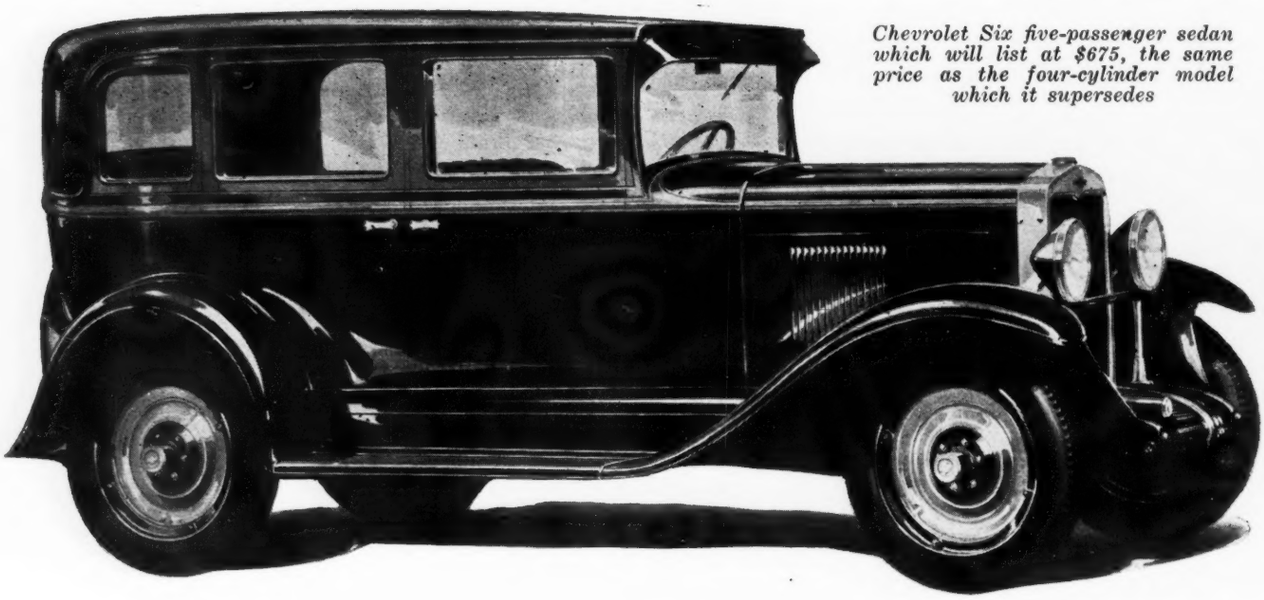
It is concluded from the results that the speed of impeller operation may be increased to at least 6000 r.p.m. without imposing any serious performance limitation—the volumetric efficiency is not seriously reduced and the power required per pound of air delivered is not increased excessively at this speed. The results obtained with the 4-in. supercharger indicate that good performance characteristics may be obtained with this relatively small machine, which lends itself to a compact type of construction so much desired in aircraft practice.

When the three sizes of machines are compared on a basis of the same rate of air delivery it is seen that the performance characteristics are the same in general, except that the power loss introduced by high speeds of operation result in somewhat greater power requirements for the smallest supercharger.

A complete report of these tests is contained in Report No. 284 of the National Advisory Committee for Aeronautics, "The Comparative Performance of Roots Type Aircraft Engine Superchargers as Affected by Change in Impeller Speed and Displacement," by Marsden Ware and Ernest E. Wilson.

THE new assembling plant of General Motors Corp. in Poland was dedicated on Sept. 20, representatives of the press and numerous invited guests, representatives of Poland's industry and commerce, being present. The new works, which will be used exclusively for assembling Chevrolet cars, have sufficient capacity to turn out 2000 vehicles before the end of the year. The majority of the parts are imported from the United States, but General Motors representatives declared they would make every effort to buy in the Polish market as soon as possible. If the results are satisfactory, assembling plants for other General Motors makes will be installed later.

TESTS made at the Bureau of Standards have shown that repeated stresses of magnetic material influence the magnetic properties of the material. The magnetic changes brought about are such as would be caused by the partial relief or redistribution of initially existing internal stresses. The fact that magnetic changes are produced by repeated stresses even below the endurance limit suggests the probability that understressing results in the partial relief or redistribution of the internal stresses. Some of the beneficial effects of understressing may be explained on this basis. The tests are fully described in Research Paper No. 26, by M. F. Fischer of the Bureau of Standards.



Chevrolet Six five-passenger sedan which will list at $675, the same price as the four-cylinder model which it supersedes

Chevrolet Begins Production

Will Sell in Same Price Range as Former Four-Cylinder Model. Deliveries Start Jan. 1

A SIX-CYLINDER model referred to as "the outstanding Chevrolet of Chevrolet history" is announced by the Chevrolet Motor Co. for 1929. It will sell at practically the same prices as the four-cylinder series which it supersedes.

According to company announcements, production of the new model was begun this week. By Dec. 15 all of the Chevrolet plants will be assembling cars for shipment to dealers, and delivery to purchasers will start Jan. 1.

W. S. Knudson, president, states that approximately 1,250,000 Chevrolets will be built during 1929, although no definite schedule has yet been set. Advance showings of the new models will be held in Detroit and New York, Nov. 24-29; Washington, D. C., Chicago and Los Angeles, Dec. 1-6; Cincinnati, San Francisco and St. Louis, Dec. 8-14; Atlanta, Dallas and Portland (Ore.), Dec. 18-22.

The plan of introductory showings, with deliveries to follow after Jan. 1, was adopted because it will take approximately five weeks to complete the change-over in the engine-production line from the four-cylinder to the six, and this will give the dealers an opportunity for profitable activity during this change-over period, when otherwise they would have been comparatively idle.

Although the appearance of the new six marks something of an epoch in motor car development, considering the prices at which it is offered, the car is said to possess no features that have not been tried and proved. Much of the chassis remains unchanged, but refinements have been made here and there, and certain parts have been strengthened, in view of the higher engine power, but basically the design is the same as that of the previous model. The valve-in-head engine, however, is entirely new.

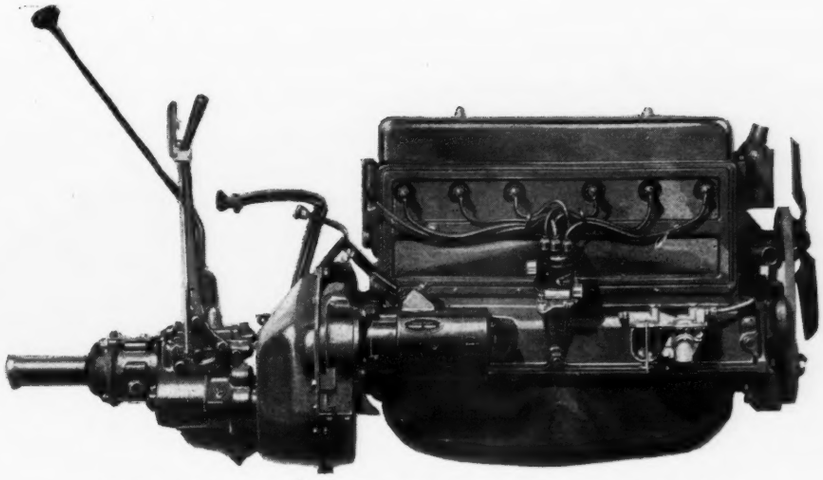
FOLLOWING is a complete list of Chevrolet Six prices, compared with those of the four:

	New Price	Old Price
2-p. Roadster	$525	$495
5-p. Phaeton	525	495
5-p. Coach	595	585
2-p. Coupe	595	595
5-p. Sedan	675	675
2-4-p. Sport cabriolet	695	695
5-p. Convertible landau	725	715
Light delivery chassis	400	395
1½-ton chassis	545	495 1-ton
1½-ton with cab	650	...
Sedan delivery	595	...

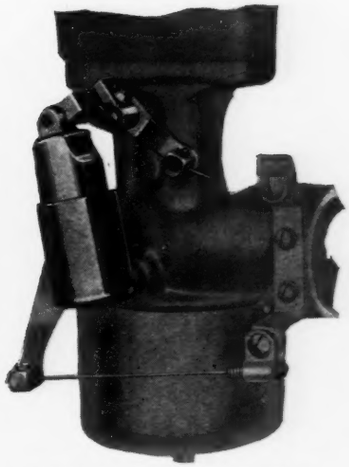
Prices range from $525 to $725, while last year the price range extended from $495 to $715. The open models are $30 higher, the coach and the landau-sedan are $10 higher each, and the prices of the four-door sedan and the coupe remain unchanged.

New features abound in the new cars. In the bodies are found full adjustable front seats in the five-passenger closed models. Headlight beam direction control is by a foot switch. An engine thermometer and oil pressure gage are included on the instrument panel. A theft-proof Electrolock is provided. Automatic windshield wipers and rear view mirrors are included in the equipment of the closed models and hand wipers on the open models. The cabriolet and convertible landau are provided with cowl lamps. Curtains on open models open with the doors.

Of the mechanical features, aside from the new engine, there might be mentioned the AC fuel pump and integral gasoline strainer which has been adopted as standard. Then there is an accelerating pump built



Right side of the new Chevrolet six-cylinder overhead valve engine



A pump is used on new Chevrolet carburetor to force extra fuel into manifold when accelerating rapidly

# of New Six

194 cu. in. Overhead Valve Engine Develops 46 hp. Bodies Are New. Wheelbase Same as Before

into the carburetor for better acceleration, and the integral AC air cleaner. The steering column shaft is now solid. The rear axle cover plate has an internal oil deflector for better lubrication of the differential.

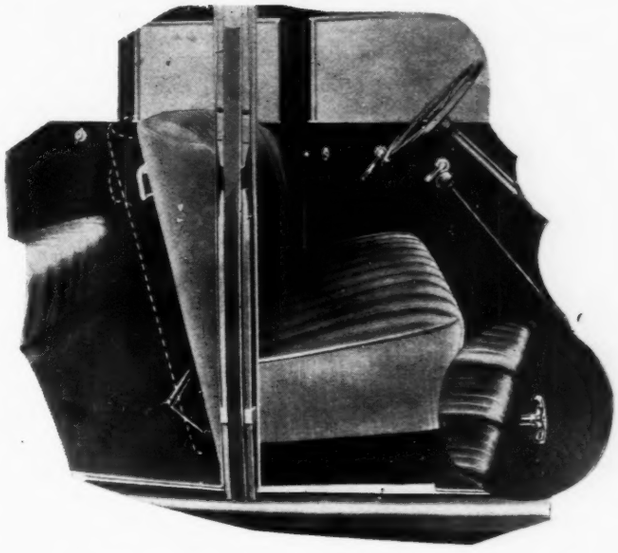
Newness in style is provided by new Fisher bodies with a new molding treatment and the adoption of a front end with flat hood, an Hispano-type radiator shell and a false pan front between the front spring horns. The wheelbase and the overall dimensions remain unchanged, but the seats are said to be wider and more comfortable.

The new six-cylinder engine incorporteed in the Chevrolet can properly be designated as a low speed engine, as engine speeds run at present. The speed at which the maximum of 46 hp. is developed is not announced, but since the engine has a displacement of 194 cu. in. with its bore and stroke of 3 5/16 by 3¾ in., it should provide exceptional low speed accelerating characteristics under all conditions and a minimum of engine vibration at high road speeds.

At 60 m.p.h. the engine turns over at 2700 r.p.m. There is no sharp peak in the power curve but it is almost flat between 2500 and 2700 r.p.m. The compression ratio is 5.01 to 1.

A 46 lb. crankshaft is supported on three main bearings, and the camshaft also has three bearings. Following are the dimensions of the various bearings:

	Crankshaft		Camshaft	
	Diam.	Length	Diam	Length
Front	1 15/16	1¾	1 13/16	1 13/16
Center	2	2	1 25/32	1⅛
Rear	2 1/16	2 3/16	1⅝	1⅜
Crankpin	2	1⅜	.....	.....



Driver's seat in all closed models is adjustable by means of a regulator as shown

Connecting rods are 8¾ in. between centers and are provided with splash dippers at the lower ends. Piston pins are locked in the upper ends of the rods and bear directly on the cast iron of the pistons. The latter are fitted with three rings each, two 5/32 in. compression rings and one 5/32 in. oil ring. Piston pins are 1 in. in diameter and 2 15/16 in. long.

An offset type of combustion chamber design has been worked out for the new engine. Spark plugs are located at the extreme left of the chamber and in a pocket somewhat above the main chamber. Valves are located directly over the piston, and the combustion chamber extends only to within slightly more than ½ in. of the cylinder bore on the side opposite to the spark plugs, leaving a "low clearance" space at this end which should aid in reducing detonation.

Valve operation is substantially the same as on the previous four-cylinder model, with push rods extending from the camshaft to the rocker arms. Valves are 1 13/32 in. in diameter, while the stems have a diameter of 5/16 in. Positive wick feed lubrication is pro-

(*Continued on page 738*)

First with the News

Reliable and Accurate

News of the Industry

PAGE 736 VOLUME 59 *Philadelphia, Saturday, November 17, 1928* NUMBER 20

Factories Nearing Turn to Operations for 1929

PHILADELPHIA, Nov. 17—Output of the automobile factories is approaching the low point of the year, a renewed upward movement being scheduled to begin late this month or early in December, as plants now engaged in changes again come into operation. Due to Ford's activity as well as that of several other large companies that are remaining in production, the current recession has not brought the level of operations below the best marks of previous years at this season.

The retail market continues in good condition, the seasonal accumulation of used cars being little, if any, greater than usual. Dealers in many sections of the country are now holding sales to bring down stocks of the second-hand vehicles.

Truck production is declining in sympathy with the trend in car output, but the recession is proportionately much less, and sustained activity in trucks will help motor vehicle production in the two final months of the year to make a particularly good showing.

Graham-Paige Company to Run Factory Branches

DETROIT, Nov. 15—Graham-Paige New York City Corp. has been formed and has acquired controlling interest in the Dalley, Jennings, Graham Corp., New York; Pyke Motors Corp., Brooklyn; Hosp Doyle Motor Corp., Newark, all of which will be operated as factory branches. Officers of Graham-Paige New York City Corp. are R. A. Graham, president; C. H. Jennings, vice-president; W. O. Crabtree, vice-president and sales manager; W. H. Garrison, treasurer, and W. L. Graham, secretary.

Hadas Joins G. M. Truck

DETROIT, Nov. 15—Frank H. Hadas has been appointed factory manager of General Motors Truck Co., Pontiac, succeeding H. J. Warner, who becomes assistant to Paul W. Seiler, president. Mr. Hadas was connected with the Ford Motor Co. for 20 years.

De Soto October Output 9562

DETROIT, Nov. 12—Production of De Soto cars in October totaled 9562, an increase from the total of 7836 set up in September. Capacity production will be continued this month.

Gordon–Muskegon in Camshaft Merger

MUSKEGON, Nov. 12—Consolidation of the L. O. Gordon Mfg. Co. and the Muskegon Motor Specialties Co., both of Muskegon, into a new $1,000,000 camshaft manufacturing company, is proposed to the stockholders of the latter company. Unanimous approval of the officers and directors of both companies and by all of the stockholders of the L. O. Gordon company has been given and consummation of the merger is expected this week at a special meeting of stockholders.

Falcon Plant to Make Willys-Overland Bodies

ELYRIA, OHIO, Nov. 13—The plant of the Falcon-Knight Motors Co. here is being remodeled preparatory to the manufacture here of all coupe bodies of the Willys-Overland Co. The plant for the past six months has been turning out Falcon-Knight coupe bodies. When the 800,000 sq. ft. of floor space are adapted to the new needs, the plant will produce 250 to 300 coupe bodies a day, including two models of Willys-Knight and the Whippet. Willys-Knight and Overland light truck bodies also are to be made.

To Make Cirrus Engine Here

NEW YORK, Nov. 14—American Cirrus Engine, Inc., has been organized to manufacture and sell Cirrus airplane engines in the United States. Definite plans have not yet been announced but organizers hope to be on a quantity production basis within about five months. This engine is of British manufacture, vertical type, air cooled.

Fiat Plans Changes in Purchases Here

PHILADELPHIA, Nov. 15—The Fiat company will revise its list of American suppliers for 1929 and is seeking information from producers of semi-manufactured and finished automotive products who are desirous of participating in Fiat business. Information sought covers producing capacities and commercial and financial references and is to be sent to Fiat, Ufficio Approvvigionamenti, Via Nizza, 250 Turin, Italy.

Auto-Lite Net $6,449,957

TOLEDO, Nov. 15—Electric Auto-Lite Co. and subsidiaries earned net profits of $6,449,957 after all charges except Federal taxes in the first nine months of 1928 as compared with $2,363,475 in the same period in 1927. The report now includes earnings of the former U.S.L. Battery Corp. Third quarter earnings were $2,756,372 which was equivalent to $3.01 per share on common after providing for preferred dividends.

Hutto Names Directors

DETROIT, Nov. 13—At the annual stockholders' meeting of the Hutto Engineering Co., Frank J. Tone, president of the Carborundum Co., Niagara Falls, and George R. Raynor, vice-president of the same company, were elected to the board of directors of the Hutto company. They succeed Howell E. Sayre, of New York, and Walter R. Munro, of Buffalo. The other members of the board are M. C. Hutto, president, and P. D. Bates, secretary-treasurer.

Cripps Joins Graham-Paige

DETROIT, Nov. 15—The Graham-Paige Motors Corp. has announced the appointment as body engineer of A. A. Cripps. Mr. Cripps is well-known in the industry for his work in the development of closed car bodies. He received his early training in the carriage building industry in England, and in 1904, joined the automotive industry. He came to the United States in 1913.

Ford to Sell Share in European Holdings

Organizes $35,000,000 Company in England to Take Over Assembly Plant

LONDON, Nov. 13—A new British company is being formed with $35,000,000 capital to acquire Ford companies in Great Britain, Ireland, France, Holland, Sweden, Germany, Spain, Belgium, Denmark, Finland and Italy, according to announcement here today. The prospectus inviting public subscriptions will show net profits exceeding $5,000,000 per annum during the past six years and assets comprising land, buildings, stock, etc., of $20,000,000; patents, goodwill $3,000,000, and cash, $12,000,000. Sixty per cent of the purchase price is payable by shares in the new company and 40 per cent in cash.

Directors are to be Henry Ford, Edsel Ford, Charles Sorensen, Sir James Davies, Sir Percival Perry and two others not yet appointed. Perry, who originally had charge of Ford Manchester plant, will be chairman of the company.

The company will acquire manufacturing and selling rights for all Ford products in the British Isles and Europe, except Russia; Asia Minor and Africa, except British possessions, also the temporary right to sell tractors throughout the world.

To Build 200,000 a Year

The assets include the Manchester plant with an annual capacity of 40,000 cars and trucks, the Cork plant with capacity of 30,000 tractors, and 300-acre site at Dagenham near London for a new plant to be built with capacity for 200,000 cars and trucks per annum. The Manchester plant is to be extended for producing components for assembly throughout Europe and for Model T replacements.

The public is to be invited to subscribe $12,500,000 and directors, employees and others will take $1,500,000. No part of the public issue will be underwritten but the American Ford company will take at par any shares not subscribed for foregoing.

Briggs to Build Bodies in Highland Park Plant

DETROIT, Nov. 14—Considerable portion of the Highland Park plant of the Ford Motor Co. has been leased to the Briggs Mfg. Co., it was revealed today. A statement that part of the plant has been leased was issued by Ford officials after denying reports published in New York that Briggs had bought the Highland Park plant.

For some time rumors have been current in the automotive industry that the Highland Park plant would be largely devoted to body manufacture, but nothing definite came of the rumors until today's statement. The announcement is causing considerable speculation in the industry on whether or not Briggs will eventually furnish Ford its entire body requirements. Briggs has held large body contracts on the new Ford Model A and a large portion of the present Briggs plants have been given over to Ford body production.

Ford Plans Tire Plant on Brazilian Plantation

DETROIT, Nov. 15—Henry Ford announced today that manufacture of tires and other rubber products will be undertaken in Brazil in connection with the Ford Motor Co. rubber plantation. Manufacture of finished products from Brazilian rubber should be located in Brazil, Mr. Ford said, adding that it was due the country to keep much of the industry growing out of the plantation in the country itself. He said further:

"What the people of the interior of Brazil need is to have their economic life stabilized by fair returns for their labor paid in cash and their mode of living brought up to modern standards in sanitation and in prevention and cure of diseases."

Devore and Batten Among Vestris Lost

NEW YORK, Nov. 14—Among the passengers aboard the S. S. Vestris, which sank off the Virginia capes this week were Earl Devore and Norman K. Batten, racing drivers, accompanied by their wives; Conrad Slaughter of Chicago, an auditor of the International Harvester Co., and Mrs. Slaughter, and Alfred C. B. Fletcher of San Francisco, on his way to take charge of South American sales of the Caterpillar Tractor Co., and Mrs. Fletcher.

Mr. Devore and Mr. Batten and Mr. and Mrs. Fletcher, were among those listed as still missing late this week, while Mrs. Devore, Mrs. Slaughter and Mrs. Batten have been rescued.

The racing drivers were on their way to South America to make definite arrangements for a series of races in which they and six other American drivers were to participate.

Mr. Fletcher was well-known in both San Francisco and New York as a foreign trade expert. He was appointed district manager for the Caterpillar Tractor Co. last June with the eastern coast of South America as his territory.

General Motors Export Co. reports none of its personnel aboard the ship but there were 600 Chevrolets, a quantity of parts and several show jobs consigned to General Motors, Argentine. Devore and Batten's racing cars also were part of the automotive cargo.

Studebaker Adds 12 Records

WASHINGTON, Nov. 14 — Twelve new records for fully equipped stock cars were established by a Studebaker President Eight when it averaged 85.2 m.p.h. for 24 hours on the Atlantic City Speedway, Nov. 11-12.

Business in Brief

Written by the Guaranty Trust Co., New York, exclusively for AUTOMOTIVE INDUSTRIES.

NEW YORK, Nov. 15—The seasonal stimulation of general trade has been enhanced by the national election on Nov. 6, and a tone of industrial confidence for the coming year predominates.

CHAIN STORE SALES

Sales of 24 chain-store companies during October amounted to $129,154,441, an increase of $18,296,778, or 16 per cent above sales during the corresponding period last year. Sales during the first 10 months this year for these same stores amounted to $1,059,630,785, marking an increase of $160,657,608 above the total for the corresponding period in 1927.

FREIGHT CAR LOADINGS

Car loadings for the week ended Oct. 27 totaled 1,161,976 cars, which represent a decrease of 119 cars below those for the preceding week and an increase of 49,160 cars above the total for the corresponding week last year.

BANK DEBITS

Bank debits to individual accounts outside of New York City for the week ended Nov. 7 were 11 per cent above those for the similar period a year ago.

FISHER'S INDEX

Professor Fisher's index of wholesale commodity prices for the week ended Nov. 10 was 97.6, which compares with 97.9 the week before and 98.4 two weeks before.

BROKERS' LOANS

Brokers' loans in New York City for the week ended Nov. 7 showed an increase of $73,000,000, bringing the total up to $4,980,000,000 and making a new high for all time for the sixth successive week.

FEDERAL RESERVE REPORT

Likewise, the reporting Federal Reserve member banks for that week showed a decrease of $57,000,000 in investments, with an approximately equivalent increase in loans secured by stocks and bonds.

The consolidated statement of the Federal Reserve banks for the week ended Nov. 7 showed increases of $25,100,000 in holdings of discounted bills and of $8,300,000 in bills bought in the open market. There were decreases of $4,400,000 in holdings of United States Government securities and of $41,200,000 in member bank reserve deposits.

Rubber Prices Lower

NEW YORK, Nov. 12—Crude rubber prices showed a slight decline on inactive trading last week, according to F. R. Henderson Corp. Stocks in London were decreased to 22,919 tons with arrivals in New York from Nov. 1 to the end of last week estimated at 5300 tons.

Chevrolet Begins Production of New Six-Cylinder Line

(Continued from page 735)

vided for the push rods, and a direct oil feed to the completely inclosed rocker arm shaft. Camshaft drive is by means of gears.

Lubrication of the engine is by means of a combination splash and gravity feed system. A pump delivers the oil under pressure to the oil distributor which in turn delivers it to pockets above the main and camshaft bearings. Standpipes are provided in the main bearing mounting bosses to prevent sedimentation and foreign matter entering the bearing. Connecting rods are lubricated by dip, the splash also serving for piston pin and piston lubrication. As mentioned, there is a direct feed from the oil distributor to the rocker arm shaft and wick feed to the push rods.

A vane type pump has been developed for the lubricating system. It is located in the lower crankcase and is driven by a short inclined shaft from the camshaft. The upper end of this shaft, pinned to the pump driveshaft, drives the ignition distributor located at the left of the cylinder block and provided with an external spark advance adjustment. This unit and the starter and generator are of Delco-Remy manufacture.

Inlet and exhaust manifolds are of the three and four-port types respectively, with a heat interchange jacket for the inlet riser. As mentioned, an accelerating pump and air cleaner are mounted on the Carter carburetor. The AC fuel pump, as usual, is driven off the camshaft by a separate eccentric. An 11-gal. tank is provided at the rear of the chassis.

Driving units are of the same general design as formerly, but a better steel is used for the transmission gears and they are heavier and the main shaft has 10 instead of six splines. The rear axle also is made heavier and the reduction is 42 to 11. The latter has a banjo type one-piece housing with an oil deflector inside the inspection cover. New Departure ball bearings are used throughout the rear axle as well as in the front wheels. The rear axle gears also are heavier than formerly.

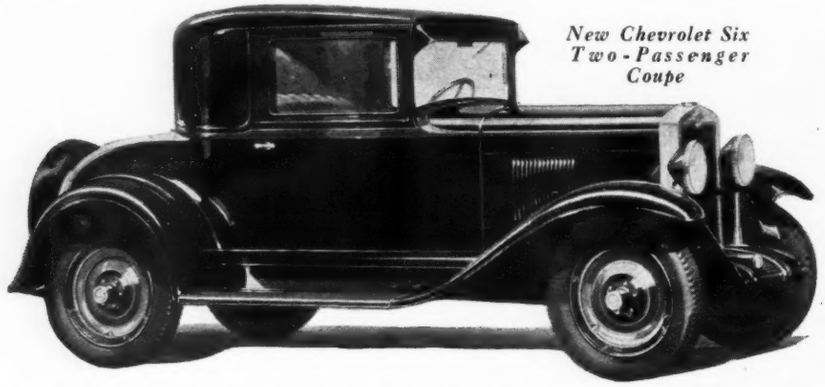
A Harrison cellular radiator, and an integral water pump and two-bladed fan, driven by a V-type belt, form the major units of the cooling system. The belt also drives the generator, and belt-adjustment is effected by moving the generator.

The four-wheel brakes are continued, but the rear wheel service brakes have been redesigned. They are now composed of two brake bands with an external equalizer. Adjustment is made at the wheel. Lining for these brakes is now 3/16 in. thick as against 5/32 in. formerly. Steel disk wheels are standard on all models, and they carry 4.50-20 balloon tires. The steering gear is of the worm-and-gear type, with the worm shaft mounted on ball bearings.

Springs are unchanged in length and width, and shock absorbing rebound control leaf is continued. Spark and throttle controls are located on the dash. Instrument panels are indirectly lighted. Head lamp rims and radiator shell are chrome-plated.

A new type of steel running board with the rubber mat vulcanized and rubber riveted to the steel is used.

Front and rear spring horns have integral bumper brackets. The front cross-member has deep channels at the ends which curve into a flattened channel at the center. With the decorative cover at the rear of the chassis eliminated, the rear cross-member is changed from a plate-type to an open-work riveted channel section. To make the muffler leak-proof, the exhaust pipe is provided with beaded ends. Each half of the rocker arm shaft is mounted in three brackets, with bolts passing through the shaft to prevent rotation and improve alignment. The water pump is of the double vane type and has lubricated metallic packing. The transmission gears have modified seven-pitch teeth. The exhaust valves close at 4 deg. past top dead center and the inlets open at the same time. There are 104 teeth on the flywheel, while the starter pinion has 10 teeth.



New Chevrolet Six Two-Passenger Coupe

New Straight-Eights Mark German Show

Closed Models Take First Place in Popularity—Six Wheel Buses Increase

BERLIN, Nov. 10—The largest automobile show ever held in this city opened this week with 600 exhibitors. An outstanding feature is the large increase in the number of eight-cylinder models, 11 new German straight-eights being shown. Four-cylinder cars are fewer in number. Of the car models exhibited by German makers, 28 have a piston displacement of two liters (122 cu. in.), 28 four liters (244 cu. in.), while three-liter engines follow next in order.

Valve-in-head engines are becoming more popular and battery ignition shows a decided advance. Single-plate clutches also are gaining ground. German makers have developed a new method of fastening the clutch lining to the steel disk without rivets, the lining material being molded with the disk in place.

Four-speed gearboxes have the preference and the auxiliary over-speed gear developed by Maybach is found on many German cars. Semi-elliptic springs are used exclusively. Mechanical brakes are in the majority but hydraulic brakes are gaining.

As to body models, limousines and sedans are in greatest popular demand and few roadsters are seen on the stands of German makers. All of the German automobile manufacturers with two exceptions fit their own engines.

Some of the most interesting developments have taken place in the field of large buses. Numerous six-wheel bus chassis are shown and some of them combine the feature of swinging axle-halves with the six-wheel construction. A new front-driven bus 40 ft. long has a carrying capacity of 100 passengers. Of the bus chassis, 34 have engines of eight liters (488 cu. in.) displacement, and 24 of 10 liters (610 cu. in.). The majority of the bus engines are of the six-cylinder type. Valve-in-head construction and magneto ignition are clearly preferred for bus use. Cone clutches are used in most of the buses, these being followed by multiple disk and single plate in the order named. Most of the large chassis have separate gearboxes, and four speeds are the rule. The semi-elliptic springs either have sliding shoes at their ends or are mounted in rubber shock insulators.

Marmon Adds Speedsters

INDIANAPOLIS, Nov. 12—Marmon Motor Car Co. has added touring speedsters to its Series 68 and 78 models, the first being priced $1,625 and the second $2,065. The speedsters are designed for six passengers through unusually wide front seats. A variety of light and dark combinations are provided.

Automotive Steels Advance in Price

Increase in Semi-Finished Group Brings Rise by Sheet Producers

NEW YORK, Nov. 15—Immediately following announcement by one of the leading independents of a $1 per ton advance in the price of semi-finished steel descriptions, a number of sheet mills chalked up a $2 per ton advance on blue annealed, black and full-finished automobile sheets, bringing the price for blue annealed to 2.10 cents, for black to 2.85 cents, and for full-finished body stock to 4.10 cents, Pittsburgh. Strip-steel prices are being adjusted on a basis commensurate with the advance in semi-finished material.

Whether rollers will be able to step up the price of their products to net them a profit margin that will not in a large measure be absorbed by higher prices for their semi-finished material, depends largely upon the first-quarter 1929 demand which has not yet begun to develop very heavily. If the 2.10 cents price for blue annealed can be generally maintained, the base price on hot-rolled strip for material for 6-in. and over in width will be raised proportionately in first quarter transactions in which the new card of extras will govern.

Cold-rolled strip-steel is stronger at 2.85 cents, Pittsburgh. With low-priced contracts for hot-rolled steel bars more and more nearing completion, the 1.95 cents, Pittsburgh, price is becoming the ruling quotation for representative tonnages, although some 1.90 cents large contract business is supposed to have been booked not so very long ago. The official price for hot-rolled steel bars is now 2.00 cents, Pittsburgh, and the mills are aiming to make this level the first-quarter inside price.

Demand for automotive alloy steels is fair. Somewhat better interest is reported to be shown by automotive consumers in bolts and nuts. It is a foregone conclusion that output of sheet and strip-steel mills will show a decline from the October record, but for all that the month will prove to be an unusually good November for the steel industry.

Pig Iron—Demand continues brisk. Furnaces have very little iron to sell for 1928 shipment, and consumers are striving to increase their supply.

Aluminum—While September imports were the heaviest in a year, it is pointed out that total imports for the year's first nine months were less than half of the corresponding period of 1927.

Copper—The market has settled down to a slightly more quiet pace, with electrolytic quoted at 16 cents, delivered Connecticut and 16⅛ cents, delivered Middle West. Demand for automotive brasses is fair.

Lead—While all other metals were either firm or bound toward higher levels, the leading lead producer announced a $3 per ton reduction in contract price.

Promoted

F. L. Barrett who has been elevated to the manager of districts desk at Hudson Motor Car Co.

Chevrolet and Overland Prepare for Record 1929

TOLEDO, Nov. 9—Employment in Toledo automotive plants is continuing approximately 50 per cent ahead of what it was a year ago. Both the Willys-Overland Co. and the Chevrolet Motors Ohio Co., have been changing production schedules and readjusting to make ready for new offerings. George D. Moore, vice-president and general manager of the Chevrolet plant here which makes all the Chevrolet and Pontiac transmissions, said normal production would be under way again about Nov. 15.

President John N. Willys of the Willys-Overland Co., is predicting a 5,000,000-car year for 1929 and every effort is being made to keep the Willys-Overland plant at peak production and ready to go with the changes to be introduced on 1929 products.

Louisville Sales Increase

LOUISVILLE, KY., Nov. 12—Automotive trade in Louisville is showing a 36 per cent gain for the 1928 season, as compared with that of 1927. October business in 1928 was 750 cars as against 481 in October, 1927, and followed a good gain in September, when 854 cars were sold, as against 567 in September of last year. For the 10 months there have been 8392 cars sold, as against 6169 during the first 10 months of 1927.

Ohio Employment Off 5%

COLUMBUS, Nov. 12—Bureau of Business Research of Ohio State University in a report covering employment in the automobile and automobile parts industries in Ohio in October shows a decline of 5 per cent from September and an increase of 38 per cent over October, 1927. Of the 51 reporting concerns, 30 showed increases in October employment over September, 20 showed decreases and one showed no change.

Reo Speeds Erection of Speed Wagon Unit

Will Use Present Space for Car Production—Will Present New Line

DETROIT, Nov. 8—Work on the new $350,000 commercial vehicle plant of Reo Motor Car Co. is now well under way and will be completed late this month. The structure will have a total floor space of 300,000 sq. ft. Space now being used for Speed Wagon manufacture will no more than take care of an increased demand for passenger cars in 1929, officials declare. In addition, the demand for Speed Wagons and other commercial vehicles next year is expected to require additional space for their construction.

October was the fourth biggest month in Reo history from the standpoint of retail Speed Wagon sales, according to Carl Parker, assistant sales manager. "Not only are 1928 Speed Wagon shipments to date nearly one-third greater than for the entire calendar year 1927," said Mr. Parker, "but they exceed by a substantial margin the total Speed Wagon shipments for any previous full year. For the past two months retail sales have been considerably in excess of factory shipments. Stocks of Speed Wagons are at the lowest figure they have reached in years and outlook is for continued high sales."

To Introduce New Car

LANSING, Nov. 12—Information is in circulation that Reo is about to introduce a new automobile. No details are available except that the car is to be somewhat lower in price than the Flying Cloud; and that it will supplement, and not replace, the Flying Cloud.

Officials of the company were reticent about the new car but admitted that such a car was in process of going into production, and stated that public announcement would be made about Dec. 15.

Reo Adds 145 Dealers

DETROIT, Nov. 10—According to C. E. Eldridge, sales manager of the Reo Motor Car Company, 21 new dealers signed Reo franchises in the past six days, bringing the total net gain since Aug. 1 to 145. Mr. Eldridge expressed the belief that the Reo dealer organization would pass the 1500 mark early next year.

Lycoming Places $2,500,000 Order

WILLIAMSPORT, PA., Nov. 13—Lycoming Mfg. Co., subsidiary of Auburn Automobile Co., has released material commitments for the first quarter of 1929, covering rough forgings and parts other than those made by itself and used in its manufacture of engines, to the extent of $2,500,000. This represents the largest single material release in the company's history.

Men of the Industry and What They Are Doing

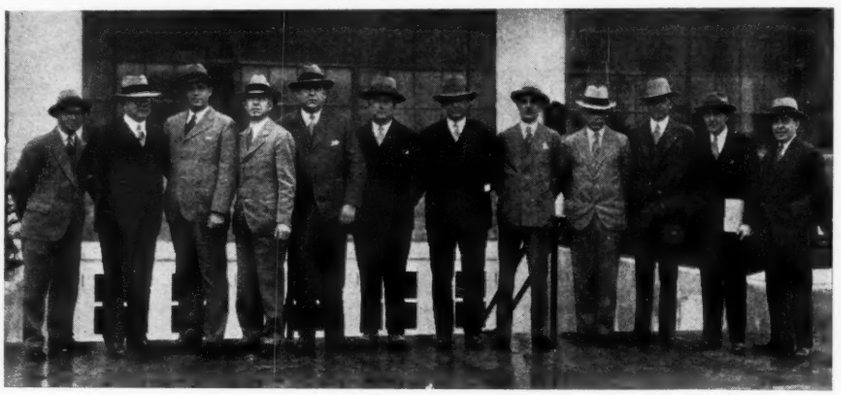
H. O. Smith and Aides Visit European Plants

H. O. Smith, chief of the automotive division, Department of Commerce, arrived in Paris the first week in November and, in company with H. H. Kelly, automotive trade commissioner to Europe, visited several of the French factories, notably the Citroen organization, where he came in personal contact with Andre Citroen.

Mr. Smith, Mr. Kelly, and Harold R. Buckley, who has just come to Paris to take up the post of automotive trade commissioner, in succession to Mr. Kelly, left later for Brussels, Berlin, Prague, Vienna, Milan, Turin and Rome. They will visit American assembly plants in Belgium and Germany and also German and Italian automobile factories, returning to Paris about Nov. 19.

After four years in Europe, first as trade commissioner, and later as automotive trade commissioner, Mr. Kelly will return to the United States on Nov. 23 to enter the export department of the Hudson Motor Car Co. Mr. Kelly founded the American Automotive Club of Europe, and was its president until a few weeks ago.

His successor, Mr. Buckley, arrives from Sidney, Australia, where he was automotive trade commissioner. During the war he was in the U. S. Flying Corps in France, with the rank of captain. He entered business in Detroit after leaving the service, remaining there three years and for the following two years was in Cuba. The two succeeding years were spent in Russia with the American Relief Administration, and in 1925 he entered the diplomatic service.



A Jury of Durant Officials

It just happened there were 12 Durant men in this Lansing party. Left to right they are C. A. Wethered, advertising; M. H. Krieger, factory manager; B. C. Sprowl, traffic manager; L. D. Haas, assistant to Mr. De Bow; J. W. De Bow, Western district sales manager, all of the Lansing organization; T. S. Johnston, assistant to W. C. Durant; H. J. Shorter, assistant sales manager; D. J. Lewis, financial department, all of the Elizabeth organization; W. H. Chapman, comptroller, Lansing; R. N. McCormick, special representative, Elizabeth; H. C. Tiffany, general advertising manager, Elizabeth, and W. H. McIlhenny, service manager, Lansing

Haynes Adds U.S.C.C. Duties

Frederick J. Haynes, recently chairman of the board of directors of Dodge Brothers, Inc., and for the last four years a director of the United States Chamber of Commerce, has been appointed national vice-chairman of the chamber's national defense committee. Mr. Haynes also is chairman of the national organization's highway and motor transport committee.

Blackall Succeeds Father

Frederick S. Blackall, Jr., has been appointed general manager of the Taft-Peirce Mfg. Co., Woonsocket, R. I., succeeding his father, F. S. Blackall, Sr., who died recently. Mr. Blackall is also assistant secretary of the company and a member of the board.

Corcoran Succeeds Strattan

President Myron T. Forbes has appointed Edward J. Corcoran manager of the New England branch of the Pierce-Arrow Motor Car Co., and Frank S. Strattan, who has been manager for about a year, has returned to the factory sales department.

Boosters Elect Sawyer

Detroit Automotive Booster's Club No. 19 has elected the following officers: P. J. Sawyer of the Spencer-Smith Machine Co., president; A. R. Sandt, General Motors Corp., vice-president; W. J. Leitheiser, Superior Piston Ring Co., treasurer, and C. S. Ward, Detroit Ball Bearing Co., secretary. New directors are W. McPherson Smith, of the Spencer-Smith Machine Co.; E. A. French, Lorraine Sales Co., Charles Hohn, American Hammered Piston Ring Co., and E. R. Harvey of the Michigan Motor Bearing Co. The club gave a diamond B. pin to David R. Rodger of the Federal Mogul Corp., retiring president.

French Car Makers Here

H. M. Ainsworth, director general, and Herbert E. Taylor, of Automobiles Hotchkiss, St. Denis, France, are in this country studying production in the automobile industry here. They plan to spend about three weeks visiting various plants and obtaining ideas as to American production methods and equipment.

Rentschler Named Director

Frederick B. Rentschler, president of Pratt & Whitney Aircraft Co., has been made a director of the newly formed Boeing Airplane & Transport Co.

G.M. Commission Ends Trip

The European automotive commission which has been on a six weeks' visit to America as the guests of General Motors Export Co. has completed its tour and the following members have sailed for Europe: Emmanuel Ricardo of General Motors (France); Harry Forman of General Motors, Ltd., London; Johannes Stahlberg of General Motors G.m.b.H., Berlin; J. Smet of General Motors Continental, Antwerp; Eric Bergsten of General Motors International, Copenhagen. The rest of the party are staying longer on other missions for their own operations. During the six weeks the commission was in America they visited New York, Atlantic City, Washington, Detroit, Niagara Falls and Oshawa. B. F. Bunker of General Motors Export Co., sailed for Bombay via Europe, Nov. 17. Mr. Bunker, who formerly was with Oakland Motor Car Co., will be sales promotion manager of General Motors India, Ltd.

Bendix Back From Europe

Vincent Bendix, president of the Bendix Corp., has returned from abroad after a five weeks' business trip. Satisfactory business has been developed in England, France and Germany, he said, and continued gain is looked for in this field. The company has developed a disk wheel and brake for use on airplanes which has been adopted by several leading manufacturers here and abroad. Company plants have been operating at peak despite the fact that capacity has been doubled.

Willys-Overland Net Rises to $8,557,399

Third-Quarter Earnings Also Increase Over 1927—Murray Shows Gain

TOLEDO, Nov. 14—Willys-Overland Co. reports for the first nine months this year, earnings of $8,557,399 after all charges but before Federal taxes. This compares with $7,306,184 earned in the same period last year. For the third quarter this year earnings were $2,146,584 after charges but before Federal tax, this comparing with $1,250,631 in the third quarter last year.

Murray Earnings $1,342,555

DETROIT, Nov. 10—Murray Corp. of America reports net earnings for the first nine months of the year of $1,342,555, equal to $4.94 a share on 269,068 no par common shares, compared with $311,342 in the first nine months of 1927. Third-quarter profit was $699,064, equal to $2.58 a common share, against a net loss of 259,699 in the third 1927 quarter.

Oakes Products Net $166,641

DETROIT, Nov. 12—Oakes Products Corp. reports net earnings for the three months ended Sept. 30, 1928, after all charges, including Federal taxes, were $166,641, equal to $3.49 a share on the 40,000 shares of Class B stock outstanding after payment of Class A dividends. Earnings for the third quarter were in excess of dividend requirements on both classes of stock for the year.

"These figures for the quarter ended Sept. 30 do not reflect earnings which will result from three products which the company is just beginning to manufacture and which should add a very large volume of business," said Claire L. Barnes, president.

Pennsylvania Section Holds Brake Session

PHILADELPHIA, Nov. 14—An exceptionally large number of engineers and service men listened and contributed to a discussion of brakes at the November meeting of the Pennsylvania Section, Society of Automotive Engineers, held here this week.

The meeting was led by John A. C. Warner, Studebaker Corp., and the speakers included P. M. Heldt, technical editor, *Automotive Industries;* H. H. Allen, Bureau of Standards; E. B. Neil, manager research department, Chilton Class Journal Co., and H. B. Hewitt, service manager, Philadelphia Rapid Transit Co.

Postal Receipts Higher

WASHINGTON, Nov. 15—Indicating a steadily increasing volume of business in the nation is the fact that October postal receipts at 50 industrial cities showed an increase for October, 1928, of 5.54 per cent over October, 1927.

Vauxhall Chief

Leslie Walton, Chairman of Vauxhall, who will arrange showing here as part of 'round world trip.

Elcar Offers New Line Priced $995 to $1,195

ELKHART, IND., Nov. 13—Elcar Motor Co. has introduced a new six-cylinder line, known as the Model 75, with a price range of $995 to $1,195. The outstanding mechanical change from the present Model 70 is use of internal Lockheed brakes as against external brakes of the same make. Bumpers and shock absorbers are included in the standard equipment. Models and prices follow:

Sedan	$1,195
Club sedan	1,095
Landau roadster	1,165
Touring	1,075
Roadster	995
Coupe, four-pass.	1,165
Roadster, four-pass.	1,145

Brown Co. Incorporated

SYRACUSE, Nov. 12—The partnership firm of the Brown Co., this city, has been incorporated as the Brown Corp. with an authorized capitalization of $500,000. G. H. Brown continues as president and treasurer, and H. W. Brown as vice-president and secretary. Business is reported 100 per cent larger than in previous years.

Packard Electric Expands

WARREN, OHIO, Nov. 12—Packard Electric Co. has purchased the battery cable business of Gilfillan Bros., Inc., Kansas City, the sale not including inventory or plant equipment. With the taking over of this business Packard Electric is planning new merchandising features.

M. H. Fesler

BRIDGEPORT, CONN., Nov. 12—M. H. Fesler, sales manager of the Automatic Machine Co., this city, died in Cleveland, Nov. 8, following an operation for appendicitis.

Financial Notes

Timken Roller Bearing Co. stockholders will meet Dec. 4 to vote on a 2 to 1 stock split-up. Directors declared the quarterly dividend of $1.50, placing the stock on $6 annual basis against $4 regular and $1 extra previously.

American-La France and Foamite Corp. reports net profit for the first nine months of the year on all operations except commercial trucks of $412,119 and net loss from its truck business of $283,439. Profit on general business for the quarter ended Sept. 30 was $92,120 with loss on commercial truck operations of $102,539.

Packard Motor Car Co. has declared an extra dividend of 50 cents payable Dec. 31 to stockholders of record Dec. 12.

Air Investors, Inc., organized under the laws of Delaware, has floated an issue of 60,000 shares, convertible preference stock, at $36 a share. This company was organized to invest in established companies in aircraft and allied industries. The stock is convertible at any time into common stock, share for share, and is callable as a whole or in part at $52 a share.

Bellanca Aircraft Corp. has issued a call to stockholders to meet on Nov. 20 to act on the proposal to increase common stock from 20,000 to 500,000 shares. It is proposed to exchange three shares of the new stock for each share now outstanding and to use the balance for retiring preferred stock and expanding plant and production facilities.

Paramount Cab Mfg. Corp. reports for October total sales of $471,075 and net profit of $150,021 before Federal taxes.

Motor Dealers' Credit Corp. subsidiaries in foreign countries showed a gain in net profits in the four months ended Sept. 1, according to A. G. Rumpf, president. The company handles time sales of Studebaker cars.

Checker Cab Mfg. Co. reports net earnings of $595,944 in the first nine months this year. The recently introduced new model developed sales of $5,000,000 in the week following its introduction, according to Morris Markin, president.

Edward G. Budd Mfg. Co. reports earnings of $356,576 in the third quarter this year, comparing with $318,018 in the preceding quarter and with $21,401 in the third quarter last year. Stockholders of Budd Wheel Co. have been offered rights to subscribe to new stock at $21 a share in ratio of 40 per cent of their holdings. A special stockholders' meeting of Budd Wheel Co. has been called for Jan. 9 to vote on increasing the authorized stock to 300,000 from 200,000.

C. G. Spring & Bumper Co. reports net loss for the fiscal year ended Aug. 31 as $225,589. This compares with net profit after all charges for the previous year of $318,656, or $1.62 a share, on common stock after preferred dividends.

British Registration Gains 12.7% in Year

Passenger Car Total Rises to 877,277 and Trucks to 294,190; Buses Drop

LONDON, Nov. 10—Statistics issued by the Ministry of Transport show that the number of passenger cars registered on Aug. 31 last was 877,277, an increase of 99,221 during the preceding 12 months, or approximately 12.7 per cent. Motorcycles increased by 19,052 to 690,672, and trucks by 19,439 to 294,190. Under the classification "motor hackneys," which embraces taxicabs, coaches and buses, a falling-off is shown, registrations dropping from 95,676 last year to 93,429 this year.

A big reduction is also apparent in the number of new passenger cars registered during the three months June-August this year as compared with the preceding three months (March-May). During the latter period new registrations amounted to 56,118, whereas in former period (June-August) there were only 39,430, which clearly shows the seasonal falling off in demand after midsummer, more marked this year than hitherto. Of the new cars registered between June 1 and Aug. 31, 69 per cent were sedans and other forms of closed cars, which compares with 66 per cent during March-May and 43 per cent in the corresponding period last year.

Tire Exports Increase to 8,836,000 in 1927

WASHINGTON, Nov. 15—A statistical table showing the increase in tire exports from the eight leading nations from 1922 to the end of 1927, made public by the Department of Commerce, shows an average annual increase amounting to 1,000,000 each year during that period.

In 1922, the United States was exporting 1,326,000 casings while the seven other nations exported 2,513,000, for a total of 3,839,000 casings. In 1927 the U. S. exports amounted to 2,811,000 of the total 8,836,000 world exports of casings. Canada jumped from 290,000 casings exported in 1922 to 1,679,000 in 1927; France from 1,210,000 in 1922 to 2,112,000 in 1927; Italy from 330,000 in 1922 to 726,000 in 1927; United Kingdom from 271,000 in 1922 to 893,000 in 1927; Germany dropped from 192,000 in 1922 to 154,000 in 1927; Japan increased from 150,000 in 1922 to 165,000 in 1927, and Belgium from 70,000 in 1922 to 296,000 in 1927.

Graham-Paige Adds 1040 Dealers

DETROIT, Nov. 12—Graham-Paige Motors Corp. added 1040 new dealers during the past 10 months, making a total of 1780 in the United States and Canada, and 2093 including overseas dealers. In October alone 168 new dealers were signed.

Show Speeds Sales in British Market

WASHINGTON, Nov. 15—Following the motor show, the automotive industry in England is speeding up production with demand for light cars particularly good and manufacturers facing difficulty of meeting immediate deliveries, the Department of Commerce is informed by its London office. Several factories are working overtime and extra shifts have been started in a number of other plants. Sales of popular American closed cars are above average for the season and the outlook for the immediate future is said to be "very good."

Hansa to Quit Combine of German Manufacturers

WASHINGTON, Nov. 15—Advices to the Department of Commerce from Bremen state that Hansa-Lloyd-Werke, a large automobile manufacturing company with its factory in Bremen, Germany, has decided to leave the combination known as the Gemeinschaft Deutscher Automobilfabriken (GDA), as of Jan. 1, 1929. The GDA consists of the firm mentioned, the Brennabor-Werke and N.A.G. (Nationale Automobilgesellschaft), which have for some years maintained a joint selling organization under the name mentioned.

Briggs Profit $3,953,650

DETROIT, Nov. 10—Briggs Mfg. Co. reports net profit for the first nine months of $3,953,650, against $2,568,944 in 1927. Profit for the third-quarter totaled $1,900,096, against a net loss of $464,337 in the third 1927 quarter.

Canadian Exports 124% Ahead of '27

September Total More Than Double 1927 Mark But Lower Than August

WASHINGTON, Nov. 15—Canadian automobile exports dropped 15 per cent in September from the August total, according to statistics received by the Department of Commerce showing a total of $3,574,374 shipments. Exports in August totaled $4,216,903. The September total, however, represented an increase of 124 per cent over September, 1927.

Average value of passenger cars exported in August from Canada was $393 while this figure rose to $433 in September. Australia was Canada's best customer for passenger cars and British India the best market for trucks. New Zealand was in second position for passenger cars and Australia held that position for trucks.

Uruguay Increases Duty

WASHINGTON, Nov. 15—Uruguay has revised customs duties on automobiles as follows, according to the Department of Commerce:

On passenger automobiles in general, a 10 per cent increase in duties; on passenger automobiles giving less than 120 kilometers per 20 liters of gasoline, an additional 10 per cent. Trucks and commercial tractors, no increase, duty being continued at rate of 29 per cent of respective valuations; tractors for agricultural purposes remain on the free list. The general rates of duty applying to imports of automobiles and replacement parts run from 59 per cent of the official valuation of automobiles, valued up to 1000 pesos, to 69 per cent on cars of a value higher than 3000 pesos.

American Methods and Equipment Enable Opel to Take Lead as German Producer

WASHINGTON, Nov. 15—Adoption of American methods of mass production is listed as one of the outstanding reasons for the success of the firm of Adam Opel, in southwest Germany, now the leading producer of automobiles in that country with half of the annual output of German automobiles to its credit, according to the Department of Commerce.

Several members of the firm inspected automobile plants in the United States some years ago, and Opel became the first German automobile manufacturer to put modern mass production methods into effect at its plant at Ruedesheim Am Rhein, which is now equipped to a large extent with American machinery and especially American machine tools.

The German production of passenger cars in 1927 was approximately 70,000 units; and the estimates for the year of 1928 are placed at 85,000 units. The present rate of production at the Opel plant averages 125 per day or about 37,500 per year, with a capacity for 250 per day. In addition the plant is said to be equipped to increase its production rapidly.

The products of the plant are handled by a large network of dealers throughout the country selected as far as possible so as to handle the Opel products exclusively.

The firm is still a private company although it is expected shortly to become a stock company capitalized at $12,000,000, with the stock, however, held largely by the Opel family.

Marmon Executives Back Plane Company

Will be Separate Organization But Officers Will Aid in Development

INDIANAPOLIS, Nov. 12—H. H. Brooks, retiring general sales director of the Marmon Motor Car Co., will head a new company in Indianapolis to be engaged in the development and manufacture on a large scale of commercial airplane engines and later the production and nation-wide distribution of airplanes.

This announcement was made by G. M. Williams, president of the Marmon Motor Car Co., who, with a group of associates, is now perfecting a tentative organization. Although he made known only a few details of the project, he said that the new organization would have no direct relationship with the Marmon company and that a plant in Indianapolis will be opened in the near future.

It was also stated that in all likelihood Col. Howard Marmon, while retaining his position as vice-president in charge of engineering of the Marmon company, will be responsible for the engineering development of the airplane engine project. Mr. Williams said the complete plane will be the development of one of the best known aircraft engineers in the world and the culmination of a number of years of experimental work.

Mr. Brooks, head of the new enterprise, has a background of more than 12 years of association with the Marmon company, during much of which time he was general sales director. Mr. Brooks has used a plane in many long business trips throughout the country. Mr. Williams likewise has been closely associated with aeronautical development since 1915. At one time he was general manager of the Dayton-Wright Co. and is well-versed in design, manufacture and sale of modern planes.

Bean Builds Warehouse

LANSING, Nov. 10—The John Bean Mfg. Co. has let contract for the construction of a three-story brick warehouse, part of an expansion program by the company involving an expenditure of between $60,000 and $75,000. The new warehouse is to cost approximately $35,000 and will provide floor space of about 15,000 sq. ft. The company has just completed the construction of a one-story assembling building 60 by 100 ft., at a cost of about $12,000 and also has rebuilt its office building, adding another story to the one-story structure.

Duckworth Adds Plant

SPRINGFIELD, MASS., Nov. 12—Duckworth Chain & Mfg. Co., producers of chains for automobile timers, motorcycle chains and chain drives for factory use, has purchased the factory building of the Bozart Rug Co. here. This will afford twice as much space as the present Duckworth buildings. The expansion follows a large increase of business by the company, especially in chain drives.

A Handful That Will Grow to 450,000

The Studebaker Corp. of America is cooperating with the Indiana State Forestry Department in the reforestration of half of its 800-acre proving grounds. M. A. Thorne, superintendent of the proving ground, is here shown participating in the planting of the first of 450,000 seedling trees

Headlight Manufacture Started by Delco-Remy

ANDERSON, IND., Nov. 12—Delco-Remy Corp. has started manufacture of automobile headlights, according to C. E. Wilson, president and general manager. This extends the activities of the corporation to include the entire lighting system of a car as cowl lights, and combination tail and stop lights have been manufactured at the Anderson plant for the past two years.

Coincident with this announcement came word that manufacture of Guide products will be continued at the Cleveland plant, though headlights also will be made at the No. 3 plant in Anderson as had been planned prior to the purchase of the Cleveland property.

Handles Molding Sales

DETROIT, Nov. 10—J. E. Eckenrode, in charge of the Detroit offices of the Grand Rapids Metalcraft Corp., will handle the sales to the general automobile trade of the National Moulding Co., newly organized Grand Rapids firm.

Auburn Plans 4500 Monthly

CHICAGO, Nov. 12—Auburn Automobile Co. by Feb. 1, 1929, will be in position to produce comfortably 4500 cars per month, due to the completion of its extensive plant expansion program.

Fisher to Increase Pontiac Output 50%

DETROIT, Nov. 10—Anticipating a production schedule next year of 1500 bodies a day, the Pontiac unit of the Fisher Body Corp. has completed plans to invest between $750,000 and $850,000 in additional buildings and equipment. Contracts for two new additions to plant No. 1 and for a $500,000 addition to the power house of the same plant already are let. A general rearrangement of machinery and installation of new equipment to enlarge production facilities also is on the program.

The additions announced today are the Fisher Body plant's second expansion of the year. Work is just now being completed on the huge new $2,000,000 steel stamping department addition started last June.

Mr. Blow said today the plant expects to start about December producing 1200 Pontiac bodies and 300 Oakland bodies a day. This will be a 50 per cent increase over the previous production record, set this year, of 1000 bodies a day.

Oakland Sees 40% Gain

PONTIAC, MICH., Nov. 12—Indications that Oakland Motor Car Co. in 1928 would top the best previous year in its history by approximately 75,000 cars, or 40 per cent, were seen by W. R. Tracy. "On the strength of present demand, I am fully confident that by the close of this year we will have sold upward of 270,000 Oakland and Pontiac cars," Mr. Tracy stated. "This would better by 40 per cent our performance in 1927, which was the most successful year we ever had."

Multi-Engines Meet Plane Power Needs

DETROIT, Nov. 10—A keen discussion of multi-engined as against single-engined airplanes developed at last Monday's session of the aviation division, Detroit Section, Society of Automotive Engineers, as a result of statements by Grover C. Loening of the Loening Aeronautical Corp., in his paper dealing with the development of the amphibian type of airplanes.

The proponents of single-engined airplanes based their claims on more economical operation, reduced fire hazard, decreased noise and better aerodynamic characteristics. It seemed to be the consensus that multi-engined planes are necessary at present, however, and may continue, due not only to public demand, but to the relative impossibility of obtaining air-cooled engines in sufficiently large size in single units to supply the requisite power.

In his discussion of the recent developments in amphibians, Mr. Loening divided this into six stages:

1. The adoption of air-cooled engines.
2. The expansion of the amphibian into the cabin type of commercial plane.
3. The development of the twin-engine Sikorsky and its excellent performance with two Wasps instead of two Whirlwinds.
4. The introduction of the twin-engined Supermarine amphibian.
5. The application of amphibian landing gear to float type of seaplane construction as in the Vought ships.
6. The expansion in interest commercially in the amphibian by such companies as Fokker, Columbia and Vought.

Croninger Coast Speaker

SAN FRANCISCO, Nov. 10—H. Harry Croninger, research engineer, addressed the November meeting of the Northern California Section of the Society of Automotive Engineers this week. His subject was "Engine and Chassis Lubrication."

He declared the way to get economical operation of automobiles and satisfactory performance was to change the oil often, though no set rule as to changing it according to mileage traveled could be laid down for every car.

Used Car Exchange Organized in Boston

BOSTON, Nov. 12—The Buick Dealers' Used Car Exchange has been organized here to operate as an outlet for such used cars as the dealers in the metropolitan Boston territory care to send in for sale. It has leased salesrooms and Robert E. Powell, for 10 years in the automobile business in Boston with Chevrolet and Buick, has been made manager. Under the plans customers will be invited to put in requests for particular types of cars, with suggested prices, and if these are not available a canvass will be made from the Buick dealers who are partners in the enterprise.

Graham and Rickenbacker on N.A.F.C. Speaker List

NEW YORK, Nov. 12—Among the speakers at the conference of the National Association of Finance Companies, to be held here Nov. 20 and 21, will be J. Gibson Jarvie, general manager of the United Dominions Trust, Ltd., of London; George E. Roberts, vice-president of the National City Bank; G. F. Meredith, vice-president of the Foreman National Bank of Chicago; M. V. Ayres, economic analyst; George M. Graham, vice-president of the Willys-Overland Co., and E. V. Rickenbacker, Cadillac Motor Car Co.

McCord Buys Plant

DETROIT, Nov. 12—Announcement has been made by the McCord Radiator & Mfg. Co. of the purchase of the plant at Clay and Hartwick Streets, formerly occupied by Dietrich, Inc. This plant has 77,000 sq. ft. of floor space and is of the single story type. It is to be used to provide increased manufacturing facilities for cellular radiators.

Aircraft Shipments Far Ahead of 1927

WASHINGTON, Nov. 15—Shipments of American aircraft, engines and parts to foreign countries during the first eight months of 1928 were valued at $2,606,603, exceeding by more than $700,000 shipments for the whole of 1927, according to the Department of Commerce.

During the first eight months of 1927, shipments abroad of aeronautic products totaled $1,010,055 in value. This year's shipments ending in August included airplanes, seaplanes and amphibians, numbering 118 and valued at $1,308,099 as compared with 63 aircraft valued at $848,568 during all of 1927.

Fairchild Consolidates Plane and Engine Plants

NEW YORK, Nov. 10—The Fairchild Airplane Mfg. Corp. has purchased the minority stock interest in the Fairchild-Caminez Engine Corp. and will consolidate the activities of the engine and airplane corporations. Harold Caminez, chief engineer, and David Caminez, treasurer, have resigned from the Fairchild-Caminez Engine Corp., according to announcement made by Sherman M. Fairchild, president.

This corporation has built and flown an eight-cylinder cam engine and a small 80 hp. four-cylinder cam engine, but as yet experimentation on these engines has not progressed to a point where performance or specifications can be announced.

New Engine Burns Crude

NEW YORK, Nov. 10—A new aircraft engine burning crude oil was described in a speech in London this week by Wing Commander Cave-Brown-Cave, who is associated with the engine development for the new airship of 5,000,000 cu. ft. capacity now being built for the British government. The engine is known as the Beardmore Tornado and weighs 8 lb. per horsepower. All tests have been met successfully.

Calendar of Coming Events

SHOWS

Aeronautical Exposition, Coliseum, Chicago .....Dec. 1-9
American Road Builders Association, Inc., Cleveland Auditorium..Jan. 14-18
Amsterdam Automobile Show...Jan. 11-20
Automobile Salon, Inc., Hotel Drake, Chicago .....Jan. 26-Feb. 2
Automobile Salon, Inc., Hotel Biltmore, Los Angeles.....Feb. 9-16
Automobile Salon, Inc., Hotel Commodore, New York .....Dec. 2-8
Automobile Salon, Inc., Palace Hotel, San Francisco .....Feb. 23-Mar. 2
Boston, Mass., Mechanics Bldg...March 2-9
Brussels .....Dec. 8-19
Buenos Aires .....Nov. 29-Dec. 9
*Chicago, National, Coliseum, Jan. 26-Feb. 2
Geneva Automobile Show.....Mar. 15-24
*New York, National, Grand Central Palace .....Jan. 5-12
Rome Automobile Show....Jan. 30-Feb. 16

* Will have special shop equipment exhibit.

Western States Metal and Machinery Exposition, Los Angeles.....Jan. 14-18

CONVENTIONS

American Road Builders Ass'n, Inc., Cleveland Auditorium .....Jan. 14-18
American Society of Mechanical Engineers, Annual Meeting, 29 W. 39th Street, New York City.....Dec. 3-7
American Society for Steel Treating, Semi-Annual Meeting, Los Angeles .....Jan. 14-18
National Highway Traffic Assoc., New York City, 12 E. 53rd St.....Dec. 11-12
Chicago Power Exhibition and Conference, Coliseum, Chicago.....Feb. 12-16
International Air Conference, Washington .....Dec. 12-14
Chicago Aeronautical Assoc., Stevens Hotel, Chicago, Ill.....Dec. 5-6
Manufacturers & Distributors of Motor Truck Equipment, Cleveland, Ohio .....Jan. 15
National Association of Finance Companies, Hotel Roosevelt, New York .....Nov. 20-21
National Automobile Dealers Association, Palmer House, Chicago..Jan. 28-29
National Metal Congress, Los Angeles .....Jan. 14-18
National Research Council, Washington .....Dec. 13-14

S. A. E.

National

Chicago, Dec. 6-7—Aeronautic.
Detroit, Book-Cadillac, Nov. 22-23—Production.
Detroit, Book-Cadillac, Jan. 15-18—Annual.
New York, Hôtel Astor, Jan 10—Annual Dinner.

Sectional

Detroit .....Nov. 22
New England .....Nov. 21
Washington .....Nov. 21